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Volume LXVI Number 11

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Are armoured shields against the invading moon.

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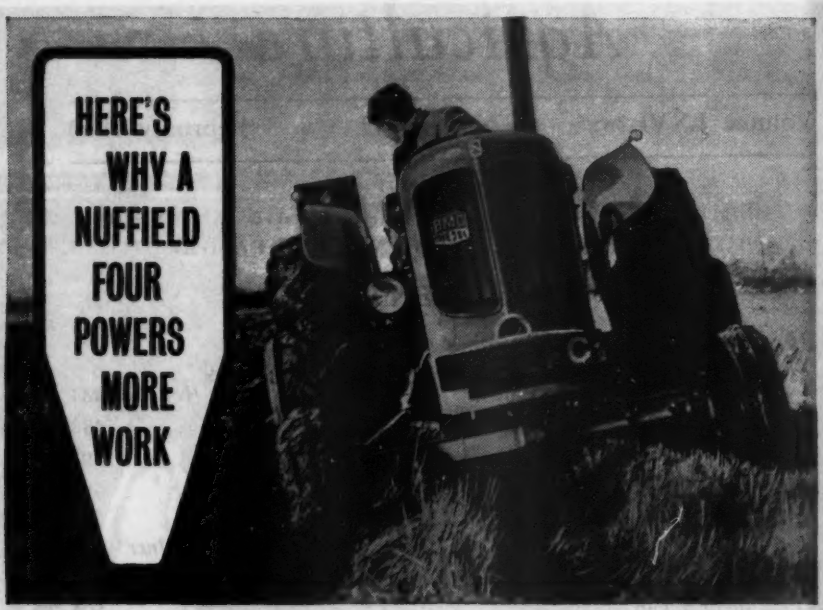

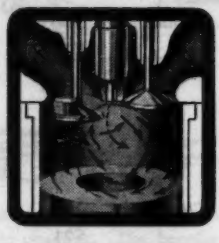

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Nutrition and Poultry Diseases

L. G. CHUBB, M.SC., A.R.I.C.
Houghton Poultry Research Station

Though even proper nutrition cannot control disease, it can greatly strengthen resistance and, combined with known drugs, it may lessen the virulence of an infection considerably.

MOST poultry-farmers know that faulty nutrition is an important factor in the outbreak and spread of certain diseases. This relationship, popularly called "nutrition and resistance to infection", must be distinguished clearly from deficiency diseases and the inadequate diets which cause them.

At the outset, it must be made quite clear that there is no known nutritional factor which can control disease. On the other hand, an adequate and balanced diet can be a valuable aid in promoting the resistance of poultry to many diseases. Unfortunately, the word "resistance" is difficult to define in simple terms. Perhaps it is best illustrated by the following example. A flock of chickens, when first coming into contact with a parasite or other infective agent, will react in one of several ways. Some birds may become acutely ill and die, others look ill and yet recover, and finally a large number may show no symptoms at all. Thus, at the former end of the scale the birds may be said to be highly susceptible, whereas at the latter end those showing no symptoms are resistant. Between these two extremes lie a whole range of interactions which nutrition can influence. The same rationale can also be applied to the invading infectious agents. Some are extremely virulent and cause a high mortality, whilst others produce only mild disease or no observable symptoms, and are therefore termed avirulent. The matter is further complicated by the great differences in susceptibility to the same infection that can exist between different breeds of fowls, and also between strains within a single breed. For example, White Leghorns have a relatively high resistance to fowl typhoid (*Salmonella gallinarum*) infection compared with, say, Brown Leghorns or Rhode Island Reds. In addition, age may also play a decisive role. Consequently, it is very difficult to state precisely the exact nutritional requirements of poultry for combating specific diseases.

Vitamins increase resistance

In the field, one has to contend with diets combining many individual nutrients, some of which may be present in larger and others in smaller amounts than are strictly necessary. Moreover, the fowls may be maintained under a wide variety of conditions, and it often becomes impossible to assess exactly the effect of nutrition on a particular infection. Unfortunately, although some of the common beliefs that certain nutritional factors are implicated in the course of a particular infection are founded upon observations in the field, subsequent rigidly-controlled experiments have shown them to be false. However, there is abundant evidence that a few nutritional factors, of which certain vitamins are the most important, can increase resistance to

infections. Such "resistance factors" may be defined as nutrients which, if present only in low levels or absent from the diet, can increase the virulence of an infection, but when supplied at higher levels will give some protection.

Probably the most important nutrient in this respect is vitamin A. This is required to maintain a healthy condition of the skin, eyes and alimentary canal. Chickens receiving a diet low in this vitamin may suffer some destruction of these membranes, and become prone to infections via these routes. If growing chickens are regularly given more vitamin A than they require for normal body needs, there is an increase in resistance to infectious coryza, *Ascaridia* infections and *Capillaria* worms.

Vitamin A not required to meet the day-to-day needs of the fowl is stored in the liver, and it has been found that such reserves are considerably depleted in coccidiosis and various forms of the leucosis complex. There is also some evidence that an adequate amount of fresh cod liver oil can accelerate recovery from coccidiosis, which effect may be due in part to its vitamin A content. On the other hand, it has not been proved that mortality from the leucosis complex can be influenced by the level of vitamin A in the diet.

There is little evidence as yet that any individual member of the vitamin B complex can directly influence the course of different infections, but a marginal level of several of them can lead to indefinite symptoms such as retarded growth, leg weakness, poor feathering and emaciation. Such birds must obviously be more susceptible to disease than those that are adequately fed. Attempts to improve the resistance of fowls to *Salmonella* infections by adding high levels of all the vitamins (both water- and fat-soluble) to the diet have not been successful.

Rations containing high quality animal protein have been shown to increase the resistance of chickens to ascarid infection more than vegetable proteins. Skim-milk powder also has a beneficial effect on this disease, and this may be due to the high level of certain essential amino-acids, particularly lysine and tryptophan, in the diet. However, the addition of these amino-acids in pure form to the diet have not been shown to increase resistance to parasitism by this worm. There is some evidence, however, that both arginine and methionine (to a less extent) play a role in determining the establishment and maintenance of pullorum disease in young chickens.

Conversely, it is not uncommon for light outbreaks of various diseases to precipitate symptoms of nutritional deficiency. During the last few years some interest has centred on nutritional encephalomalacia, which results from a deficiency of vitamin E. This condition has proved puzzling when encountered in the field. It has often been found in fowls being fed ordinary commercial rations probably containing adequate amounts of this vitamin, and such birds have also been found to have normal blood levels of vitamin E. In addition, it has usually been found impossible to reproduce the disease with such rations in the laboratory, although it may be done by feeding a highly purified diet containing fat. This has led to a reluctance to accept the laboratory deficiency disease as identical with that occurring in the field on normal, practical diets.

Effect of stress factors

Recently, however, a concept known as "stress factors" has been intro-

duced. This implies that in the field, "stress" can arise from poor conditions of management such as crowding, wide fluctuations in brooding temperatures, and light outbreaks of disease. Under these conditions, an amount of vitamin E in the diet which would ordinarily be adequate for well-managed chickens may prove to be insufficient, and need to be increased.

This may further be illustrated by reference to the chick haemorrhagic disease. Serious losses in flocks of young growing chickens occur from time to time as the result of extensive subcutaneous and intramuscular haemorrhages. Although the condition has been associated with the use of coccidiostats, it has occurred in birds which have never received such treatment. The condition has been found where there is a light outbreak of coccidiosis or chronic respiratory disease. Many theories have been advanced regarding the causes of haemorrhagic disease, including one involving vitamin K. It has been suggested that this vitamin may be absent from or at a low level in certain rations, or that certain infections may increase the fowls' need of it. Although the condition has been found to respond to the administration of certain forms of this vitamin, other factors, as yet unknown, may be involved. This example illustrates the complexity of the relationship between nutrition and disease.

A probable contributory factor in all these problems is the high metabolic rate of chickens. This implies relatively exacting requirements for amino-acids, vitamins and certain minerals, the balance of which may easily be disturbed by the presence of disease. In any flock, birds are likely to be found at many different planes of nutrition and this, in conjunction with different types of management and the possible presence of disease, makes an unravelling of the problem exceedingly difficult.

Diet and the acidity of the gizzard

Finally, another aspect which may have a considerable influence on the problem is the effect of diet on the defence mechanism of the alimentary canal. The gastric juices of most animals, being acid, may offer considerable protection against pathogenic bacteria entering tissues via the intestinal tract.

Higher infection rates occur in chickens given *Salmonella gallinarum* by mouth with a normal balanced ration than in other birds receiving whole wheat only. This difference is associated with a much greater destruction of the bacteria in the gizzard of the wheat-fed birds compared with those receiving the balanced mash, and is due to the higher acidity in this organ of the wheat-fed birds. When the increased acidity is neutralized by feeding diets containing alkali, no destruction of the *Salmonella gallinarum* occurs.

The consistency of the food may also have a profound effect on the infection rate of this disease. A greater degree of destruction of the bacteria occurs in the gizzard of birds fed whole wheat than in those fed finely ground wheat. This difference is probably due to the fact that in chickens fed whole wheat, the bacteria are exposed to the action of the gastric juices for a relatively long time, with a consequently greater degree of bacterial destruction—the food being retained in the gizzard until it is ground before being released into the duodenum.

It has also been found in turkeys that infection by the causal organism of blackhead, *Histomonas meleagridis*, is related to the acidity or alkalinity of

the gizzard; where the diet permits the gizzard contents to remain on the acid side, little or no infection occurs, but if the gizzard is made alkaline with an alkali mixture a large number of birds develop the disease. These results therefore demonstrate that modification of the environment of the alimentary canal by dietary means can have a profound effect on the establishment of pathogenic organisms. This relationship is probably as important as the more complex effects of diet on host resistance.

How can the subject be summarized? At present there is no known nutrient which can control infectious diseases of poultry as well as vaccination or drugs. Certain deficiencies in the diet of the host may be a disadvantage to some invading parasites, but obviously a deficient diet could not be a practical method of conferring resistance to an infection. On the other hand, there is ample evidence that an adequate diet is a valuable aid in promoting the resistance of poultry to many infections. It is also becoming clear that the bactericidal effect of various regions of the alimentary canal can be considerably influenced by the nature of the food. Thus it may be possible, by dietary means, to fortify the resistance of the bird against the entry of the parasite into vulnerable organs. Combined with known therapeutic substances, such a nutritional approach may lessen considerably the virulence of an infection.

Mobile Foot-bath for Sheep

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Wye College, University of London

A foot-bath which can be taken to the sheep has practical advantages. The design described here has proved satisfactory in use at Wye.

MODERN sheep husbandry demands regular handling, for disease-control and other routine jobs. With the increasing cost of labour, driving sheep to central pens on the farm can be costly and time-wasting; necessary or desirable routine treatments may even be omitted for this reason. Furthermore, some diseases (for example, foot rot) may actually be perpetuated by the system of bringing the flock to central pens and holding paddocks, which are constantly reinfected.

If all the necessary handling equipment could be taken quickly to the flocks on the three-point linkage of a tractor, labour should be saved and the health of flocks should benefit. On the large farm, both at home and overseas, the greatest advantage would probably lie in reducing the time spent in droving; on the small intensive farm, the emphasis would be on the reduction of disease risk which such a system would provide.

The system should be of particular value in the treatment of foot rot, since the responsible organism (*Fusiformis nodosus*) cannot survive on sheep-free pasture or soil for more than fifteen days. But it is often difficult to prevent the reintroduction of foot rot to a clean pasture (rested for more than

fifteen days) when, even after routine foot-bath treatment and the segregation of affected animals, the flock has to walk over infected areas on its way to the clean grazing. This situation might be greatly improved if the foot-bath could be taken to the sheep, instead of vice versa.

Design for attachment to tractor

A start on testing the idea in practical conditions was made at Wye in 1958, with the construction of a foot-bath for attachment to the three-point linkage of a tractor. It is being used to control foot rot among the College flocks of about 400 breeding ewes, which are normally run in two or three groups.

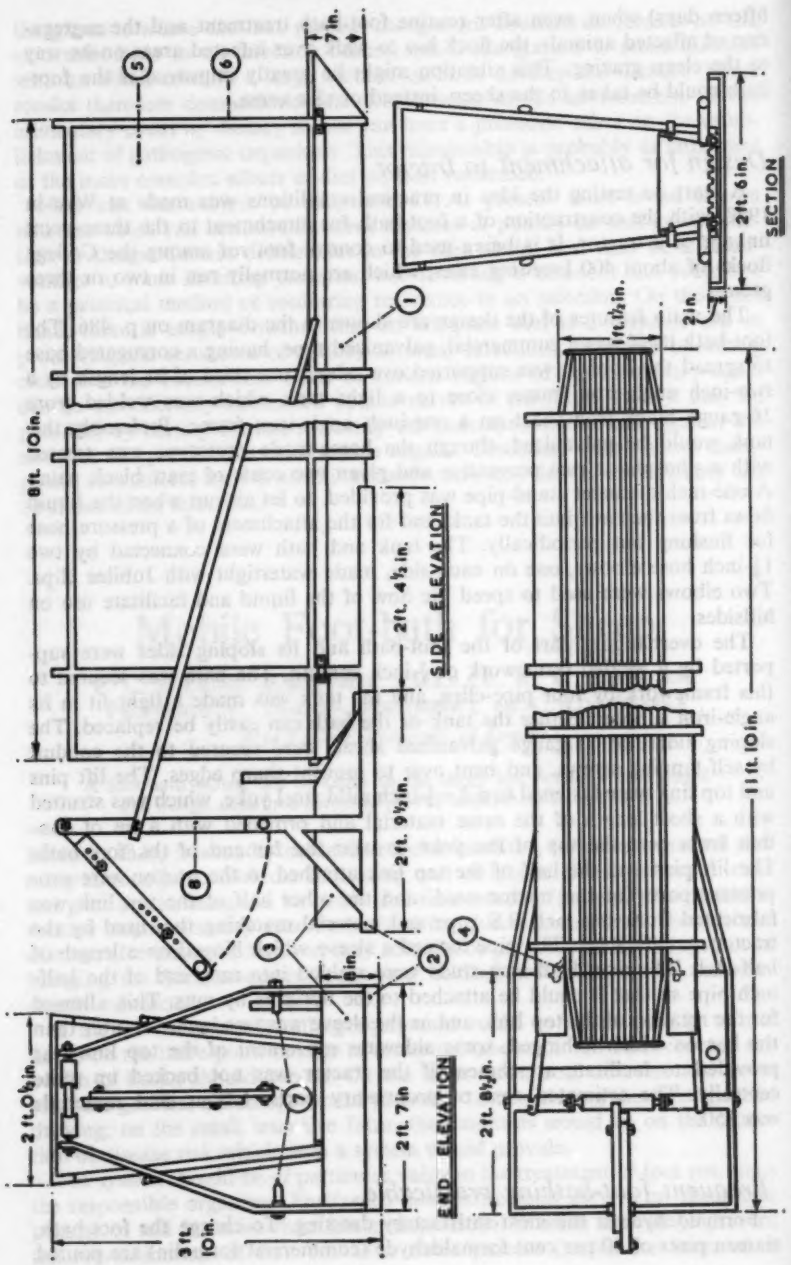
The main features of the design are shown in the diagram on p. 486. The foot-bath itself was a commercial, galvanized type, having a corrugated base to spread the hoof. It was supported over about one-third of its length by a two-inch angle-iron frame, close to a light tank which was welded from 16-gauge black iron sheet on a one-inch angle-iron frame. Preferably this tank would be galvanized, though the home-made prototype was treated with a phosphatic rust preventive and given two coats of matt black paint. A one-inch diameter stand-pipe was provided, to let air out when the liquid flows from the bath into the tank, and for the attachment of a pressure hose for flushing out periodically. The tank and bath were connected by two $1\frac{1}{4}$-inch hose elbows, one on each side, made watertight with Jubilee clips. Two elbows were used to speed the flow of the liquid and facilitate use on hillsides.

The overhanging part of the foot-bath and its sloping sides were supported by a welded framework of $\frac{3}{4}$-inch conduit. The bath was secured to this framework by four pipe-clips, and the tank was made a tight fit in its angle-iron support. Either the tank or the bath can easily be replaced. The sloping sides, of 24-gauge galvanized sheet, were secured to the conduit by self-tapping screws, and bent over to prevent sharp edges. The lift pins and top link were fastened to a $2 \times \frac{1}{2}$-inch mild steel yoke, which was strutted with a short length of the same material and provided with a tie of conduit from near the top of the yoke to near the far end of the foot-bath. The lift pins and the half of the top link attached to the tractor were proprietary parts for the tractor used, and the other half of the top link was fabricated from one-inch B.S. pipe and material matching that used by the tractor manufacturer. The pipe formed a sleeve which hinged on a length of half-inch B.S. pipe. Half-inch studs were welded into each end of the half-inch pipe so that it could be attached to the uprights by nuts. This allowed for the rotation of the top link, and as the sleeve was two inches shorter than the bar on which it hinged, some sideways movement of the top link was provided to facilitate attachment if the tractor was not backed up quite centrally. The estimated cost of proprietary parts, labour and materials was £50.

Frequent foot-bathing practicable

Formaldehyde is the most satisfactory dressing. To charge the foot-bath, sixteen pints of 40 per cent formaldehyde (commercial formalin) are poured

MOBILE FOOT-BATH FOR SHEEP



in, and followed by approximately twenty gallons of water. These quantities are sufficient to provide approximately three inches of a 4 per cent solution (that is, 10 per cent of the bought solution) throughout the bath and tank when horizontal, and the mixture all drains back into the tank when it is raised into the transport position. A depth of three inches has been found adequate in practice, though the tank has the capacity to drain up to 4½ inches from the bath when in the transport position.

The outfit is normally used in a gateway, with the gate forming one side of a funnel for the sheep, and a pair of hurdles, which are carried in the foot-bath, forming the other. If the ground is sloping so that sufficient of the liquid will not run out of the tank, the top link is unfastened and the lower links raised until the depth in the bath is enough. The hoses are then plugged, the bath lowered and the tractor removed in the usual way.

Since the flocks have been initiated into the procedure, the shepherd's dog has been able to drive the sheep, and the shepherd stands near the exit (generally at the tank end) to see that each animal pauses for a moment in the foot-bath. It is essential to let the dressing dry on the hooves, and care must be taken to arrange the bath so that the sheep do not immediately go on to wet grass. An internal farm lane often proves useful, and extra hurdles can be carried in the bath to form a temporary pen.

The design of the equipment has proved satisfactory, though care must be taken to avoid spillage, which will occur if the hydraulic lift is raised too rapidly. Important practical points in using the technique are to ensure that the sheep come to the bath with clean, thoroughly trimmed feet, move slowly through the bath, and stand on a dry site on leaving it so that the dressing dries in.

Trimming the hoofs is of course always vital, but experience has already shown that the equipment can be of value in controlling foot rot, principally because it makes frequent foot-bathing and segregation of infected animals more practicable, and reduces the risk of transferring infection from field to field. Much greater benefits would accrue if equipment such as spray and handling races were also available in mobile form.

Key to engineering drawing opposite

1. Galvanized footbath.
2. 2-inch angle-iron frame.
3. Light, 16-gauge welded iron tank.
4. One of two 1¼-inch hose elbows, made watertight with Jubilee clips.
5. Sloping sides of foot-bath.
6. Welded framework of ¾-inch conduit.
7. Lift pins and top link.
8. 2×¼-inch mild steel yoke.

Shelter and the Grazing Animal

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This account of the effects and uses of shelter is based on the paper read by Mr. Michael to the Forestry Section of the British Association at York last September.

ANIMAL existence has been described as a search for food, attempted preservation and reproduction. Among other things, preservation demands shelter. Food and shelter, however, are difficult to separate; both constitute the barest of necessities for man or beast. Much critical information is available on nutrition, but very little indeed is to be found on the subject of shelter in relation to the grazing animal.

Older generations appear to have given great thought to providing shelter, and exercised considerable ingenuity; perhaps the reawakened interest in this subject is an admission of a tendency to have overlooked it recently.

By extending the season of grass, the agronomist has encroached upon harsher periods of the year, and this should focus attention upon shelter—not that I need dwell unduly on the influence of shelter upon an early bite. Generally, adequate, natural shelter is more easily found under conditions of free range than within a restricted area: thus increased rates of stocking following grassland improvement impose a greater demand for and upon shelter.

The longer one ponders this fundamental subject, the more perplexing does it become. The apparent lack of shelter in one locality may be offset by a lessened risk of exposure; by resorting to different breeds or types; by differences of management or nutrition. Marked seasonal variation, and with it the degree or extent of exposure, introduces a further complication, so that assessment remains a long-term policy during which, again, considerable changes might have been made in the farming programme.

Undoubtedly there is much awaiting the attention of the physiologist, but a tribute must be paid to the outstanding merit of the work recently done by Blaxter and his colleagues at the Hannah Research Institute, on thermal exchanges. Practical implications of shelter should be clearer to those who have endured exposure. Exposure can and does induce stress. Other forms of stress appear to be an important affliction of present civilization. Unfortunately, a critical appraisal of stress in relation to disease and disorder is as yet in its infancy: it should help to show us the uses of shelter.

Natural body heat

In a broad sense the grazing animal is concerned with two forms of shelter; natural or erected fixed shelter, and the natural protection of wool, hair, skin and fat. Both sheep and cattle are warm-blooded animals: their body temperature is independent, within wide limits, of the medium in which they

are living. Without the delicate mechanism for regulating the production and loss of heat, the metabolic activity within the body would overheat it, causing death. If the body temperature of a warm-blooded animal is to remain under reasonable control, heat production and loss must achieve a balance, either by increased heat production or reduced heat loss.

It is interesting to reflect that both the lamb and calf normally have this mechanism fully developed at the time of leaving the womb, within which they have obtained food, warmth, and apparent oblivion to the more austere conditions which will follow birth. On a particularly cold day the creature is expelled from within this warm chamber (at between 101° and 105°) to face a temperature near freezing point. Temperature regulation is fully established, assisted by maternal care and muscular movement.

There are occasions when this provision appears inadequate; most of us are familiar with the recuperative effect of warmth upon a starved and practically dead lamb, born under conditions of severe exposure.

Animals lose heat by warming food, vaporizing water from the lungs, and by radiation and convection. The loss by radiation and convection is reduced by the fleece, and heat loss from parts of the body covered by hair, not wool, is controlled by a mechanism restricting the flow of blood to and from these areas. For each animal, therefore, there is a certain range of external temperatures within which heat production is fairly constant, but beyond the lower limit (the critical temperature), more heat must be produced to maintain a constant body temperature. When this happens, less energy from a given amount of food can be stored within the body, or used for production, and where the quality or quantity of food is inadequate the extra demand must be met from the animal's own bodily reserves.

Exposure and twin-lamb disease

A combination of cold, driving wind and rain markedly increases loss of heat from the body, and soon causes the animal to seek shelter. Different breeds and types vary in their susceptibility to exposure, and in this their natural protection plays a great part.

I have said that the study of animal disorders in relation to the stress of exposure should help to show the uses of shelter. A survey now in its fifth year yields some information on the value of woodland shelter in connection with twin-lamb disease, which is often fatal.

Why was it so common in 1955—when there were 816 cases among 21,000 ewes, against only 19, 57 and 100 cases respectively from a similar number of ewes each year in 1956–58? In 1955 the outbreaks coincided with some weeks of snow and hard weather in February and March, a phase absent (or far less severe) in the following years. The following table shows that there were fewer cases of twin-lamb diseases among sheep given access to woodland areas than among others without such access.

1955	No. of ewes	Cases recorded	Percentage recorded cases
Access to woods	1,513	11	0·7
No access to woods	19,954	816	4·7

It must be emphasized that other conditions of management care and nu-

trition are also involved, but a smaller comparison within flocks, in which part of the flock obtained access to woods, and the remainder did not, is also significant.

1955	No. of ewes	Cases recorded	Percentage recorded cases
Access to woods	523	Nil	Nil
No access to woods	1,302	66	5·0

These figures reflect the incalculable value of shelter. The following years were comparatively uneventful.

The Marginal Production Scheme of 1949 (continued with modifications until 1958), and the Hill Farming Act 1946, as amended by the Livestock Rearing Act 1951 and later legislation, have helped the improvement of hill farms, in-bye land and intakes or "ffridd". Much more advantage has been taken of this in some areas than in others. It soon became apparent that some further investigation of husbandry and management was necessary, for the sudden change of in-lamb ewes from natural hill grazings on to the vastly improved swards of the intakes caused outbreaks of lambing sickness or hypocalcaemic tetany, sometimes associated with hypomagnesaemia and entero-toxaemia. A field trial in 1950 showed, among other things, the bad influence of exposure and the advantage of shelter in relation to these disorders.

	No. of ewes	Cases recorded	Percentage recorded cases
A Natural shelter	376	21	6
B Exposure	302	79	26

A and B were adjoining groups of ewes, A having natural shelter, B on exposed ground. Ewes went sick in both groups, between 1st and 23rd April. The highest number of cases recorded on any one day in group A was four. Within group B, this number rose to fifteen on the 4th and twenty on the 10th, both days coinciding with two storm periods of high wind and rain. The higher incidence among group B is largely associated with lack of shelter.*

Allcroft has long recorded the influence of climate upon the serum magnesium levels and the evidence of clinical hypomagnesaemia in cattle. The evidence cited so far has in common the concentration of stock, change in food supplies, and the onset of foul weather.

Within an area surveyed in the early spring of 1957 and 1958, there was a strong contrast in the climate—a prolonged period of cold, searing wind in 1958 and mild weather in 1957. The incidence of metabolic disorders for both seasons reflects this difference of climate (though I would stress again that other factors are also involved).

	No. of ewes	Cases recorded	Percentage recorded cases
1957	20,486	155	0·6
1958	21,983	495	2·2

* This experiment has been recorded fully in Hill Reclamation: Aspects of Management in Relation to Metabolic Disorders of Sheep. *Vet. Rec.*, 1953, **65**, No. 24, 379–81.

The catastrophic winter of 1946-47 presented many examples of the value of shelter, with the stern reminder that over a long period, shelter without food is of little avail. Thereafter, at least within the area surveyed, the merciless thaw that followed with driving wind and rain, contributed to more deaths than occurred when the snow covered the ground. As this cold, driving rain cleared snow away from exposed areas, so banks and hedgerows held back deep snow, preventing any access to their potential normal shelter. Woodland areas were more fortunate. It was notable that flocks which had survived on levels of near starvation suffered heavier casualties in the thaw than others better fed.

From the animal standpoint, the dynamic factor is exposure. The use of existing woodland shelter when required is a matter of management; the establishment of woodland shelter a long-term policy. Movement to more sheltered areas is as old as the hills.

Breeding for heavier fleece

How does selective breeding to increase the natural protection of the fleece compare with the merits of woodland shelter? This again is a long-term policy. It is not simply a question of increased or diminished fleece protection. Other factors are involved: any apparent advantage derived is shared by other changes, in size, grazing behaviour and milking properties, to quote only a few. Pilot flocks have been kept under direct observation for many years, and even if the evidence from them is rather negative, they have provided the experience necessary before attempting controlled experiments.

The improvement in positive health and productivity coupled with a lower mortality among the progeny and further progeny with more protective fleeces is quite remarkable, and gives some indication of the stress within these flocks among ewes when carrying less protection.

An earlier controlled attempt to study this aspect (in relation to another disease problem) was wiped out during the 1946–47 winter. Eighty per cent of the conventional hill type in this flock, and two per cent of the "improved" type, survived. The "improved" were lighter fleeced sheep.

Use of woodland

But most of the earlier examples given were associated with sheep, whose fleeces were usually considered sufficiently protective.

Even so, it is reasonable to assume that there is added advantage from woodland or static shelter. The most hardy of flocks have been observed to use woodland shelter. When there is snow on the ground, accompanied by intense cold, the sheep go to the woods for the night in the late afternoon and, weather permitting, come out the following morning for a period of foraging. This behaviour may change when the thaw comes and, with more favourable weather, camping may take place in the open.

The snow surface is never above freezing point, but with intense cold on a clear night, radiation leaves it colder still. Pregnant resting sheep present a larger surface area to the surrounding air and to this cold surface; by morning, heat loss must be considerable, despite any insulating property of the fleece. How otherwise do sheep become frozen to the ground on a dry night?

Within the dense wood, loss of heat by radiation is less; air and ground are not so cold. There is a great tendency to regard snow merely as interrupting food supplies, but the increased stress imposed by intense cold is more often overlooked. This is particularly important with multiple pregnancy, when the ewe's natural period of resting is prolonged. Throughout the year, animal heat loss occurs more by radiation and convection, both wind and rain increasing this, but loss of heat by conduction through prolonged contact with the cold, snow-covered surface appears to be greatly increased. Perhaps the added virtue of dense woodland shelter is to reduce the loss of heat by radiation, convection and also conductio . Certainly the onset of disorders during extreme cold is much more dramatic than when starvation alone is implicated. Yet another point should be considered. With suitable management, which will depend upon the nature of the woodland shelter, foraging, exercise and gentle activity are more naturally maintained; and when supplementary feeding is imposed, this pattern of behaviour cushions the sudden change of diet, for such change itself can precipitate disorder.

Again, during hard weather—especially in prolonged periods of intense cold, snow and ice—it is frequently in woods that the only available water supplies may be found, other sources in the open being frozen.

From this superficial approach to some aspects of the important but comparatively new subject of bioclimatology, one point emerges. The provision of woodland shelter must be regarded in relation to food supplies, for such shelter is needed most when food is scarcest.

The value of shelter is greater in places where concentration of stock is practised particularly in winter and early spring. It is the art of shepherding to counteract excessive periods of sheltering to the detriment of foraging.

Profitable Soft Fruit

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Mr. Hinton explains how the efficiency of a soft fruit business may be tested and its strong and weak points shown up.

IN 1958, the output of soft fruit in England and Wales was estimated at £9·5 million. Most of the fruit was grown as a separate enterprise on general farms, and the rest was produced by specialists on smaller holdings. The growers' total profits would have been about £1 million. This article is designed to show how the soft fruit business can be analysed, and to serve as a guide in planning for higher profits.

The business analysis which follows has been developed from an economic survey of the soft fruit holdings centred on Newick in East Sussex.* It is concerned particularly with the specialized business, but the standards and comparisons given should prove useful to the non-specialized grower too.

These holdings vary in size from two to ten acres. Most of them are about five acres, and show an annual turnover of about £2,000. The cropping is entirely soft fruit of all types, but mainly dessert gooseberries and strawberries.

The effect of good yields on giving high profits is well known and will not be discussed here. The most certain way of increasing profits at any level of yield is by carefully organizing production to minimize expenses, while at the same time aiming at high yields. Output has the greater influence on profits, but expenditure is much more under the grower's control. Analysis of expenditure shows how the separate costs compare with each other, and these costs, in relation to the income they create, provide the basis for the examination of business performance which follows. A second analysis, considered later, is concerned with labour efficiency alone. In both cases, the measure of efficiency is based on the total cost of the factors involved and the total income of the business.

Analysing the business

In the first case, the relationship between separate factor costs and between factor costs and output is studied. This provides a method of comparing the efficiency of different holdings having varying levels of output. The examples given below show the results of this analysis for three soft fruit holdings. One has a profit of £100 an acre (after charging for unpaid labour); another, more typical, a profit of £41 an acre, and a third shows a loss of £37 an acre. To simplify the comparison, net output for each holding is taken at £370 an acre in each case. ("Net Output" is receipts—in this case

* W. L. HINTON, *Specialized Soft Fruit Holdings*, Wye College, 1959.

taken as £390 an acre—less expenditure of £20 an acre on plants and packing materials—expenses which do not themselves contribute to the true production from the holding.)

Table 1

Costs per £100 net output

	A Successful holding	B Typical holding	C Unsuccessful holding
	£	£	£
Profit or loss per acre	+100	+41	−37
PRIME COSTS			
Labour (paid and unpaid)	50	62	75
Manure	4	4	5
Machinery and equipment	10	12	15
Other	2	2	3
OVERHEAD COSTS			
Rent	2	2	2
Other	5	7	10
TOTAL	73	89	110

The costs per £100 net output shown above emphasize the overwhelming importance of labour. On a typical holding, expenses amount to £338 an acre (including plants and packing materials £20), of which £230 is for labour. Machinery expenses, though far less important, count next in significance and average one-seventh of total expenses. The greatest scope for reducing overall expense lies in improving upon the existing use of labour and machinery. These two expenses should be examined separately, but consideration should also be given to the performance of labour and machinery as a single unit in production, to show how far they are being combined to the best advantage.

The analysis for the successful holding indicates high overall efficiency and shows how well labour and equipment have been used to achieve it. This grower's labour costs are £50, one-third lower than those of the unsuccessful grower. Labour and machinery together are lower than labour alone in the case of the typical holding. The total costs per £100 net output of only £73 leave £27 as profit. Low overhead costs have also helped to achieve the good result.

The figures for the typical holding show that labour is not organized as effectively as in A, and there has not been the same effort to use machinery efficiently. Other resources have been used successfully, but labour and machinery alone (£74) exceed the total costs on A. Profits have therefore dropped from £100 per acre on holding A to £41.

The analysis for the unsuccessful holding underlines how this grower obtained his poor result. Labour management and machinery use are both very bad. Labour costs alone exceed total costs in A, while labour and machinery together exceed total costs on B. For every £100 net output the grower is losing £10. The management here is very poor, labour and machinery are used wastefully, and no attempt has been made to keep overhead costs to a minimum.

How to work out the costs

For any grower wishing to compare the performance of his own holding with the examples given, the procedure is as follows. Net output is found by deducting the amounts spent on plants and packing materials from the annual net sales; then the expense items are grouped under the following headings:

Labour
An amount for the grower's own manual labour is added—£400 where this is equivalent to a regular employee.

Manures
Expenses on manures and fertilizers for the year.

Machinery and equipment
Depreciation and repairs, fuel and oil, contract work done on the holding, transport and small replacements which are not in the closing valuation are included.

Other direct costs
Spray materials and sundry small items of expenditure, which are used up in the year's production. Plants and packing materials are excluded.

Rent
In the case of a tenant, the actual rent payment is charged. Where the holding is owned by the grower, the rental value is charged instead. In either case the appropriate deduction should be made for the use of the dwelling-house.

Other overhead costs
These expenses are independent of output. The most common, apart from rent, are bank charges, accountants' fees, water and electricity.

When values for each of the six factors have been obtained, the next step is to calculate these costs per £100 net output. (The "net output" basis is superior to the "per acre" basis where yield changes and their repercussions on cost are often overlooked: the "per £100" rating gives values which can readily be applied, and affords simple comparison of the make-up of factor costs.) "Costs per £100 net output" are obtained by dividing the costs by the net output, then multiplying the fraction by 100. For example:

Total costs £600 Net output £800

$$\frac{£600}{£800} \times 100 = £75$$

or Manure cost £40 Net output £800

$$\frac{£40}{£800} \times 100 = £5$$

The "per £100 net output" basis can only go so far in producing a standard of performance unaffected by yield changes, and is further complicated by the variations in selling price, which also influence net output. When the costs per £100 net output for one holding can be calculated on two or more years' results, the effect of these variations is reduced, and the value of the comparison is increased, particularly where net output fluctuates from year to year.

Interpretation of the figures

When interpreting his own results the grower should first consider his total costs figure, which indicates the overall level of efficiency and has a direct link with profit. (For example, total cost £90, profit £10 per £100 net output: total cost £70, profit £30.) Then each of the factors should be considered in turn. Labour can range from £50 to £75. If the labour figure is high, a reduction of 10 per cent through better management might double the profit. A normal ratio of expenses on labour and machinery in soft fruit production is 5 to 1. If the machinery proportion is high, then either too much is being spent on machinery or, more rarely, the grower may be using machinery where labour could do the work more cheaply. Where expenditure on materials (including manures) is too heavy, the grower can readily alter his policy. Overheads usually range from £7 to £12, and savings on them, though small, are important, for any saving here adds to profit in the same proportion.

The business analysis should lead the grower first to thinking of ways of using his existing resources more profitably. Where expenditure is seriously out of balance, the grower must consider adjusting the different types of expenditure to create a business which will give him the profits he wants.

Labour and profit

Since labour (paid or unpaid) alone accounts for two-thirds of the costs of soft fruit production, labour performance is usually the most important factor in business efficiency: but it cannot be compared satisfactorily on an acreage or output basis alone. This is best shown by considering the number of bearing acres covered by one man, assuming normal machinery support, and by maintaining receipts per acre at a constant level.

Table 2

Output and profit per man
(*Revenue £400 per acre*)

	Soft fruit per man		
	acres		
	2	1¼	1¼
	per cent		
Labour efficiency	100	75	62½
	£	£	£
Receipts per man	800	600	500
Labour (paid and unpaid)	400	400	400
Gross profit per man	400	200	100
Non-labour expenses	150	150	150
Profit per man	250	50	−50

Table 2 shows, for a revenue of £400 per bearing acre, the relationship between labour performance and profit for three levels of labour efficiency. For this level of output, growers whose labour coped with two bearing acres, (labour efficiency 100 per cent), made the highest profits, while growers whose use of labour was less efficient made correspondingly lower profits.

Assessment of efficiency by labour performance alone will often give a useful check on the business performance of the holding. In some cases, however, this method needs refinement. Where more or less machinery is used than is normal in support of labour, these two factors should be considered as one. The combined machinery and labour cost per £100 net output, in these circumstances, gives a better standard of comparison. Again, when yields fluctuate, it may be helpful to isolate picking-labour costs (which, unlike other labour costs, change according to yield). They are considered separately in the following section.

These models have been used to describe, in terms of input and output, the economic characteristics of successful and less successful soft fruit holdings. In the first method used, costs are related to the net output of the holding, and in the second the major cost—labour—is related to total sales. To avoid false comparisons, both methods relate costs to total output. Either analysis is a valuable guide in assessing profit and in showing how it is achieved. What must be done to raise profits is also suggested.

Casual labour

So far, attention has been given to the organization of the business as a whole and particular reference has been made to the cost of labour. Casual labour merits separate comment.

Unlike regular labour costs, casual labour expenses are a charge on the business only when there is productive work to be done. In soft fruit production, casual earnings amount to a significant part, one-third or more of the labour bill. The greater part of casual wages is spent on fruit-picking. For the strawberry crop, picking wages range from £30 to £35 a ton, and for raspberries from £35 to £40 a ton. Any lowering of these figures, by using incentive schemes, or by providing conditions attractive to the workers, or both, can lead to a real saving in costs. Attention to such methods of saving is important, since rates of pay for picking are generally determined by the demand for and the supply of pickers. These rates adjust themselves for the season according to the weight of a particular crop per acre, the competition between crops for the same labour force, and finally according to the weather conditions, which may affect the ease of picking of a given crop.

Picking costs

What this costs the grower is shown in Table 3 (on p. 498) for a range of piece-work rates for different crops. The labour requirement for picking each crop has been calculated from the average weight picked per worker in a seven-hour day, from records for two seasons.

When growers are selling to a particular market they may prefer to use day-rates instead of piece-rates. Picking on this basis, however, can lead to certain disadvantages to the employee as well as to the employer. The worker may be dissatisfied with fixed daily earnings; the grower's costs may become too high, while the amount picked per day may fall until it does not pay for supervision and marketing. One way of solving this problem is by the use of a bonus scheme to encourage the worker to pick more in a day. Any such scheme would need to take into account the rates paid per hour, the weight

of crop, and the amount of selection required of the worker. A simple measure of the ability to organize the picking of a crop is the picking cost per pound of fruit picked to a given standard.

Table 3

Picking labour: requirements and expenses

	Amount picked per worker per 7 hr day	No. of workers required to pick one ton per 7 hr day	Rate per lb	Cost per ton	Workers' earnings per 7 hr day
	lb		*d.*	£ *s.* *d.*	*s.* *d.*
Strawberries	84	27	3	28 0 0	21 0
			3½	32 13 4	24 6
Raspberries	50	45	4	37 6 8	16 8
			5	46 13 4	20 10
Black currants	74	30	3	28 0 0	18 6
			4	37 6 8	24 8
Red and white currants	70	32	3½	32 13 4	20 5
			4½	42 0 0	25 10
Dessert gooseberries	210	11	1	9 6 8	17 6
			1½	11 14 4	21 10½

The problem was approached on one holding, for the strawberry crop, in this way. Workers who picked less than 60 lb of fruit in the seven-hour day received 2*s.* 6*d.* an hour only. Those who picked 60 lb or over received in addition a bonus on the following scale:

Amount picked per worker	Bonus per lb
lb	*d.*
60–79	¼
80–99	½
100–119	¾
120 and over	1

The bonus is applied to the total quantity picked per day by each worker, and the scheme reduces picking costs. Workers are given real encouragement to increase their output, for their bonus increases sharply as the next step on the scale is reached.

Quantity picked	Bonus	Day's earnings	Cost per lb
lb	*s.* *d.*	*s.* *d.*	*d.*
59	—	17 6	3·56
70	1 5½	18 11½	3·25
90	3 9	21 3	2·83
110	6 10½	24 4½	2·66
130	10 10	28 4	2·62

It is common for a grower of soft fruit to rate his success according to the season's takings, and to go no further. But this shows only one side of the picture; it does not reveal the profit, nor is it of any use for checking what the profit ought to be. More important than this, however, it provides no guide to the improvement of profit through better management. In this discussion some attempt has been made to expose the workings of the soft fruit holding

and to reveal its potential strengths and weaknesses. This approach to profitability may in some cases merely confirm the grower's suspicions, yet by giving more precise measurements, and thereby leading to more confident decisions, business analysis can do more than this. The holding may be found to be unbalanced, either in the way money is spent or in the composition of its cropping, and more fundamental changes may be recommended. In all cases, by adding to the grower's critical knowledge, business analysis of the holding can better equip him to apply his hard-earned experience to secure higher profits from his soft fruit.

Glasshouse Statistics

England and Wales

CROPS GROWN IN GLASSHOUSES (July 1959)*

	July 1958† *acres*	July 1959 *acres*
Total Area of Glasshouses		
With heating apparatus	3,233	3,185
Without heating apparatus	670	722
Total	**3,903**	**3,907**
Crops in Glasshouses at July		
Tomatoes:		
grown in glasshouses fitted with heating apparatus	1,834	1,730
" " " not fitted with heating apparatus	496	538
Cucumbers	444	457
Mushrooms	(a)	18
Other vegetables and herbs	34	22
Grapes	23	20
Peaches and nectarines	8	8
Other fruits	6	2
Carnations	188	202
Roses	131	123
Orchids	6	5
All other flower and foliage crops	405	430
All other crops not specified above	74	64
Remaining glasshouse area (being the area unused at census date, or used for purposes not shown above)	254	288
Total	**3,903**	**3,907**

* Including Dutch light structures which were glazed at the census date.

† The July 1959 census was limited to occupiers of holdings (of more than one acre of land used for agriculture, and with not less than 1,000 sq. ft. of glass excluding lights and cloches) on which the glasshouses were run on a commercial basis. The figures for July 1958 when returns were obtained irrespective of whether the glasshouses were run on a commercial basis or not, have therefore had to be adjusted for the purpose of comparison with July 1959.

(a) Not collected.

N.A.A.S. Experimental Horticulture Stations

The Lee Valley Station

R. GARDNER, N.D.H.

Station Director

The work of this Station has so far concentrated on tomatoes, cucumbers and chrysanthemums, but cultivation problems of other glasshouse, low coverage and outdoor flower crops are included in its programme.

THE Lee* Valley Experimental Horticulture Station is the latest of the N.A.A.S. experimental stations to be established in areas of the country where horticulture is an important industry. It is concerned with experimental work on, and production techniques of, crops grown under glass, and flower crops grown in the open. The Station is in particular intended to serve the growers of the Lea Valley, but will also be the most convenient experimental centre dealing with glasshouse and flower crops for the growers of the nine counties of the Eastern Region, including Holland (Lincs), and the adjacent South-east Region counties of Middlesex and Bucks.

The site chosen has the advantage of a useful frontage on the A10 London to Cambridge road, and it lies some 2½ miles south of Ware and one mile north of Hoddesdon. Although within the Green Belt, which should safeguard it from any extensive urban encroachment, the Station is on the fringe of those areas of the Lea Valley which have suffered directly or indirectly from industrial and residential development. The site is, therefore, comparable with the average Lea Valley nursery.

The land comprises some 26 acres, and includes three main soil types. That bordering the A10 road and forming the most level area of the Station, upon which the present glasshouses have been built, is a silty brickearth of adequate depth. The natural drainage in this section is good, as the upper horizon of brickearth is underlain by gravel or by a mixture of gravel, sand and clay. The soil structure is, however, very easily damaged by heavy rainfall, or by watering too quickly or in too large a droplet size; or again by cultivation when the soil is too wet. Panning and capping then occur. Before manuring and cultural treatment, the soil is acid and low in organic matter. The other soils, which conform to the older and higher terraces of the west bank of the ancient River Lea, are a gravel/clay mixture of the Reading Beds and a stiff boulder clay on the highest and most westerly section of the Station. The latter is at present being reserved for the provision of turf loam for plant propagation.

Most of the land lies 135 feet above sea level, and faces east. The average rainfall for the locality is 24 inches, which is fairly typical of the area the Station is intended to serve. In this connection an official climatological

* The spelling "Lee" has recently been adopted by the Experimental Station to conform with the older name in the area. It seems that "Lee" has been used in Acts of Parliament since an Act of Queen Elizabeth I's reign in 1570. The spelling "Lea" was introduced by a cartographer named Saxton about 1576.

recording station has been established and, in addition to the usual meteorological data, records will be kept of the nature and extent of atmospheric pollution and its effects upon the supply of natural light to plants, both under glass and in the open. This work, which is of considerable moment to the Lea Valley producers, is being conducted under the guidance of the Department of Scientific and Industrial Research.

Close collaboration with the research institutes covering similar crops or subjects is one of the primary functions of the N.A.A.S. experimental horticulture stations. The object is to test and investigate further the findings of research under the environment of the region. This the Station at Hoddesdon is now doing under the conditions peculiar to horticulture in the Lea Valley, and to some extent for East Anglia as a whole. (It will have close links with the new Glasshouse Crops Research Institute at Littlehampton, in Sussex, and one of the major tomato experiments in progress on the Lee Valley Station is sponsored by the Institute.) Other organisations with which cooperation is being developed include the horticultural department of the National Institute of Agricultural Engineering, the John Innes Institute, the National Vegetable Research Station, the National Institute of Agricultural Botany and the University Botanic Garden at Cambridge.

Local problems

Besides engaging in experiments in collaboration with research institutes on problems of national significance, we are investigating particular local problems. An example is the current investigation on various aspects of manganese toxicity in glasshouse soils. This trouble is a feature of some of the soils of the Lea Valley. Another subject in the same category concerns the control of the glasshouse environment for the development and setting of early trusses of tomatoes, bearing in mind the poor spring light frequently prevailing in the Lea Valley area. This work will be concerted with the studies on atmospheric pollution previously referred to.

Again, the production of cucumbers has for many years been a highly specialized feature of the glasshouse industry in the Lea Valley, and it is of increasing importance because the tomato crop is less profitable now. Experimental work on cucumbers must, therefore, become one of the major tasks of the Station, and a number of carefully selected projects involving this crop are already in hand.

So far ten glasshouse units have been erected, three of them designed primarily for plant propagation and seven for crop production. Others, including mobile houses, are planned for 1960–61. The first of the present houses became available for experimental work in the spring of 1958, and a start was then made with the programme.

There are some unusual features in the design of the houses, the result of careful planning for experimental purposes by the first Station Director, Mr. E. Skillman. With the exception of the propagating houses, all the houses have been built as single units, and none is arranged in blocks on the traditional commercial pattern. The reason is that plants growing in the outer houses, and across the ends of a block of commercial houses, generally crop more heavily than those in the inner parts of a block. The chances of experimental errors due to plant position will, therefore, be less troublesome

when the houses are arranged as single units. Again, a single-unit layout, provided the spacing between units is adequate, will ensure that only a minimum of shadow is cast by one glasshouse upon another. Ventilation also becomes more adequate, and is relatively even for each house of the same design. This is in sharp contrast to the houses in a commercial block. Single houses also provide better facilities for a range of experimental work. At this point we might commend the growers of Guernsey, who have built their glasshouses in small single or twin units for many years. The more adequate ventilation and the avoidance of shade thus obtained will almost certainly have secured higher crop yields than would otherwise have been the case. Thus work conducted at the N.I.A.E. and on some of the N.A.A.S. experimental horticulture stations indicates that tomatoes in the outer houses of a block may yield 18 per cent more than those in an inner house.

The glasshouses on the Hoddesdon Station have another distinction; they have been built truly level. It is well known that glasshouses built with a gradient will tend to develop considerable differences in temperature along the length of the house. Warm air will rise to the high sections and cool air will fall to the lower levels. This can lead to different rates of plant growth and development in different parts of the house and, in the case of experimental crops, to differences in results unconnected with the experimental treatments. Considerable care was therefore taken to ensure that each glasshouse and the land inside was completely level.

The heating unit is based on a steam-to-water system under fully automatic control. The steam is generated in two oil-fired burners which are run at low pressure, 10–15 lb per sq. inch, and a supply is available for soil sterilization as well as for heating. Space heating in the glasshouses is by means of small-diameter pipes suitably arranged and spaced in relation to the crops. The water in these pipes is heated by injecting steam from the steam mains via a simple, low pressure steam injector designed at the N.I.A.E.

Experimental programme: (1) Tomatoes . . .

So far, work on tomatoes, cucumbers and chrysanthemums has been given priority, but problems connected with the cultivation of other glasshouse, low coverage and outdoor flower crops are also included in the present programme. These other crops include lettuce, house beans—both climbing French and scarlet runner types—strawberries under low coverage, freesias, dahlias, paeonies, china asters and the forcing types of antirrhinum.

Work on the tomato crop includes an important study of the effects of cultural and allied factors on the incidence of blotchy ripening and similar disorders of fruit colour and maturing. This plan is the one sponsored by the Glasshouse Crop Research Institute. A most encouraging feature of the first year's work on it is that those cultural treatments which have resulted in fewest blotchy fruit are also those which have given very satisfactory yields. The cultural factors referred to are daytime temperature levels, watering, shading and variety. The relationship of tomato fruit bronzing and the incidence of tobacco mosaic virus has also been a subject for study, in collaboration with the N.A.A.S. Plant Pathology Department. The results indicate that this disorder may be caused by more than one factor, although virus infection of the plants may sometimes be an important element.

Tomato variety trials have so far been conducted under only one temperature regimen. It is proposed to extend this work in 1960, to enable varietal response to be assessed under a number of combinations of night with day temperatures. This approach will also provide a valuable opportunity of studying the development and behaviour of early trusses under the poor natural light of the Lea Valley at different levels of temperature.

In the trials so far conducted, Ware Cross has given the best performance, and has proved superior to Potentate in yield and outstandingly so in quality. An F.1 hybrid variety bred in the Netherlands, Grower's Pride, has also given an encouraging performance, although fewer comparisons have so far been made than in the case of Ware Cross. The results with Baby Lea, on the other hand, have been disappointing on the three main counts of early yield, total yield and fruit quality.

Other studies connected with tomatoes include automatic irrigation and liquid feeding, and a comparison of the labour costs involved in operating Guernsey and English systems of training.

(2) *Cucumbers*

In the case of cucumbers, attention is now being particularly directed towards the response of the crop to temperature. As with the tomato, this study is being combined with variety trials and seasonal factors such as length of day. During the 1958 and 1959 seasons, we have been working on the comparative effects of growing the crop in small and large beds prepared from a variety of materials. The yields obtained were very similar from both sizes of bed, and from most of the materials or combinations of materials tried. Admittedly the soil base, unlike that of many established nurseries, is not yet suffering from any ill-effects that may arise from growing cucumbers year after year, but the results suggest that bed size and composition are not vital factors provided both base and bed do not suffer from compaction, which is bad for the health of the roots.

The two other current cucumber experiments have been concerned with a comparison of varieties and automatic irrigation. In the latter, the yield and quality of the fruit obtained from two systems of automatic watering, with the water applied under the control of a tensiostat, and with the equipment set to work at predetermined moisture tensions, was very close to those obtained from water applied by hose and in amounts decided by human discretion. The average yields in flats per foot run from a crop grown for twenty-five weeks were 1·83 flats from hose watering, and 1·81 and 1·79 from the two automatic systems.

When suitable houses become available, experimental work will start on two of the glasshouse flower crops which are of especial interest to the Lea Valley—roses and carnations. Meanwhile, particular attention is being given to the more extensive use of chrysanthemums as a short season catch crop after tomatoes, or as an all-the-year-round crop giving scope for alternative or rotational cropping with tomatoes.

Litterless Poultry

JOHN L. JONES

Taken to its logical conclusion, the droppings pit as a way of saving litter becomes a method for dispensing with litter altogether.

DEEP litter acts mainly as a self-sterilizing carrier of fowl droppings, and indirectly as a means of preventing vice with dense indoor stocking. The droppings pit, now in widespread use, was a first step to greater efficiency, leading to economy, longer life and better quality in the litter, and in turn to denser stocking, lower disease risk and cleaner eggs in the nest-boxes.

Why not have the entire house over a pit, into which all the droppings fall, and over which the birds stand on wire mesh? This is simply and precisely the logic behind the new and revolutionary house which Mr. David Watkinson, a young farmer near Salisbury, has started successfully.

Mr. Watkinson has arrived at litterless housing via an extended trial with hens on wire in a converted squash court. The unit which is based on this experience is 160 feet long by 40 feet wide and holds five thousand birds, an extremely dense stocking rate of one bird per 1¼ square feet. The house is divided into four sections, split into two pairs by a transverse central feed store. It is built of concrete blocks up to the damp course, and insulation blocks above that. The roof is of double sheet aluminium, a light metal whose greater initial cost is compensated by the need for lighter timbers to carry it, and the double skin provides excellent thermal insulation. Windows have been dispensed with—a feature which also aids insulation, reduces construction costs and gives complete control in using the stimulus of lighting.

Inside, the birds stand on wire mesh which is laid in 12-feet by 6-feet sections. Food in the form of meal is fed by a chain conveyor from the central food store along a galvanized trough, which takes the meal down one sub-section, curves across the bottom of the house, and returns along the other sub-section and back to the hopper. The birds are watered from 6-foot automatic waterers.

The mesh floor is raised three feet from ground level, thus providing a large droppings pit beneath. As the mesh is sectional, it can be lifted out once a year and the space cleaned out by fully mechanized methods.

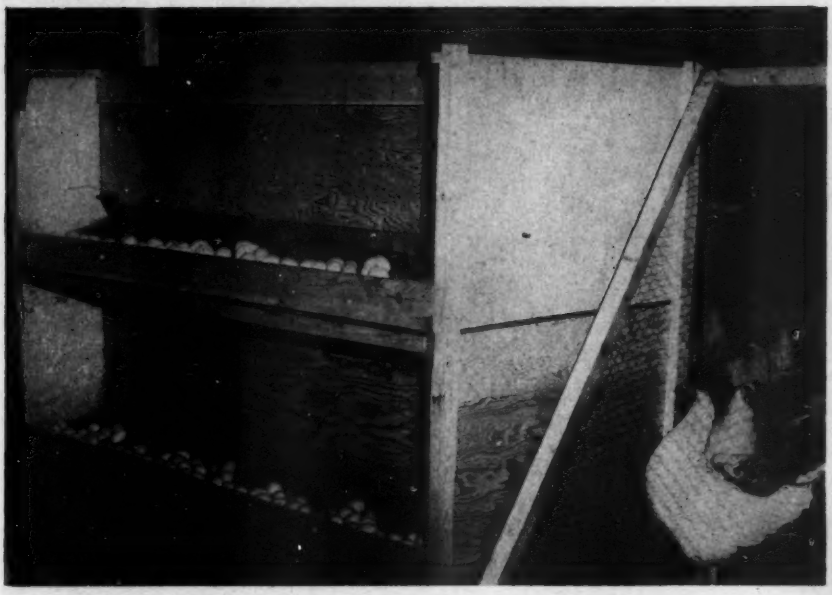
In houses with droppings pits, the need for maximum efficiency of ventilation is underlined by the tendency for the accumulated droppings to give off ammonia. In the Watkinson house, air is sucked in through baffled inlets set down one side, above the birds, and extracted by twelve multi-speed fans, linked in pairs to a controller.

Mr. Watkinson's early experience with his pilot houses has underlined the need for great care in the design of nest-boxes in litterless housing, if the dangers of vent pecking and prolapse are to be avoided. He has produced his own design of effectively-darkened roll-away nest-boxes, which has been working with success. The basic features of the design ensure that almost all the eggs are clean, and permit once-daily collection without disturbance to

Photo: *John L. Jones*

Automatic feeding in a litterless house.

Litterless Poultry (Article on pp. 504–5)



Mr. Watkinson's own successful design of roll-away nest.

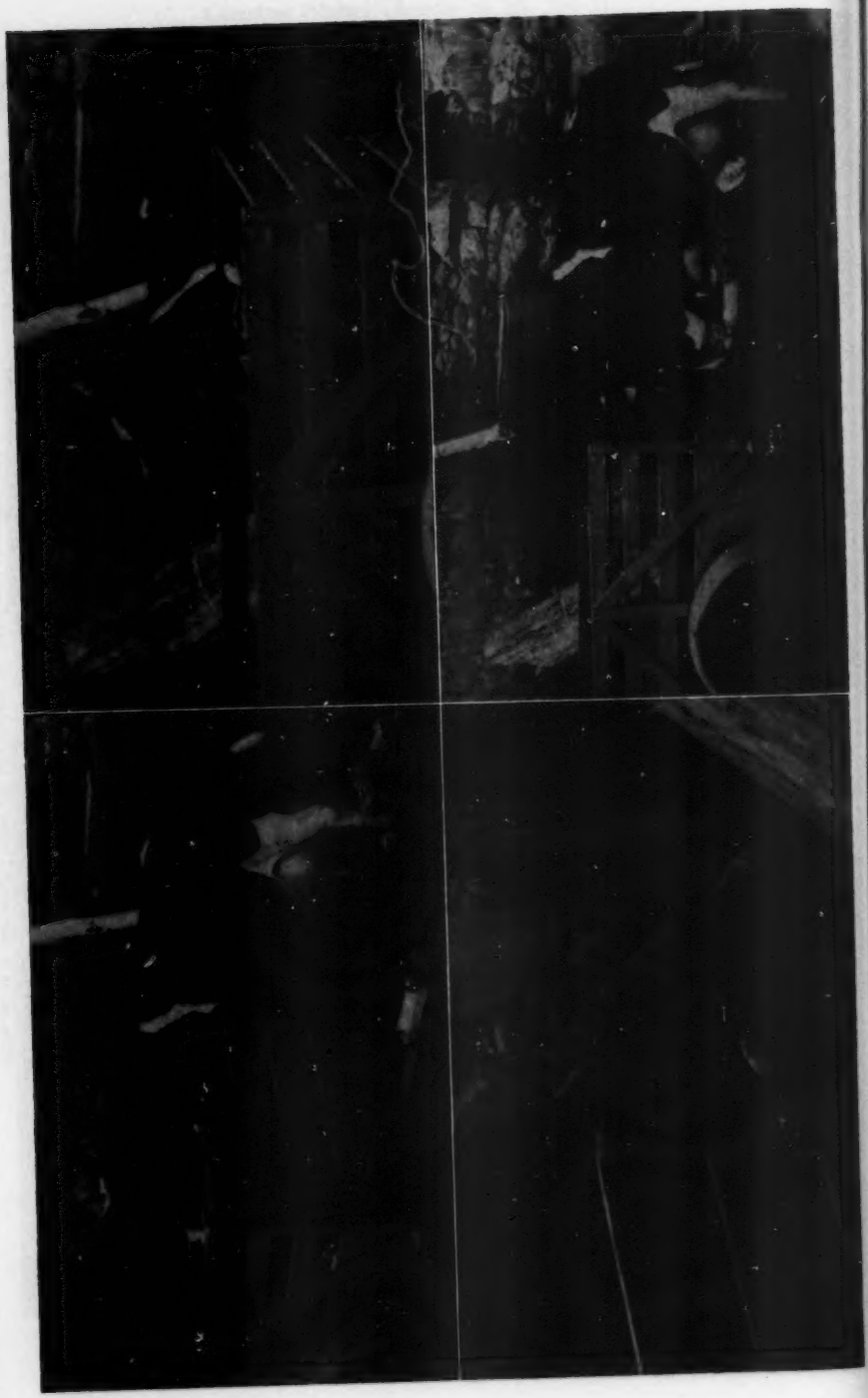
Photos: *John L. Jones*

Once every day, egg-boxes are pushed down the gangway of the house, and the eggs collected into the trays, clean and ready to be taken away.

Photo: *Crown*

The Lee Valley Station is paying particular attention to chrysanthemums as a catch crop, or as a year-round crop for alternative or rotational cropping with tomatoes.

The Lee Valley Station (Article on pp. 500–3)



the birds and with a definite discouragement of broodiness. The routine is to push a trolley of boxes down the gangway, collect the eggs, place them directly into trays, and leave the boxes in store for collection. As many as 200 eggs have been collected from one communal nest-box without any breakages. The use of this type of bulk collection nest brings large-scale egg collection nearer to the ideal of labour-saving automation.

This is a prototype house, planned and executed with imagination and script attention to detail. The outbreaks of vice sometimes associated with boredom among the layers have been conspicuously absent; so far there is no sign that vice need be a problem with litterless housing at dense rates of stocking. Fully furnished accommodation has been provided at £1 per bird.

The Tale of a Tub

GERALDINE was not as other cows. Though she lay out in the field with the rest of the herd chewing her cud, she kept her eyes fixed on the farm buildings across the way. Interesting things were always going on.

She noticed that the farmer brought iron tubs on his trailer and emptied them into a boiler. She also saw that he emptied the boiler into a trough where "those common pigs" in the next field guzzled their food twice a day. She thought about this quite a lot.

Then one day, while her companions were gazing blankly into space and thinking beautiful thoughts, as is the habit of contented cows, she strolled across to where the farmer had parked the trailer. Putting her head over the side she explored with a tentative tongue. Something tasted good but she just couldn't get her mouth to it.

"I'll waggle my tongue about a bit," she grumbled and did so with gusto, but it was of no use. Still grumbling, she wandered round the trailer. "Ah! if I can only get my knee on this end I'll manage it fine!" But cows' knees were not meant to support their weight, so poor Geraldine found that once again she was frustrated.

However, she had a keen eye. Did we not say that she was not as other cows? She spotted another bin on the ground at the back and trotted round to investigate. Her luck was in. It was full. So Geraldine got busy, with smacking sounds of delight.

But she was still grumbling when we left her. "If only I'd been a Shorthorn I'd have had the lot!"

COMMENT—But the end of this amusing story might well have been disastrous. Had the iron tubs contained pieces of uncooked meat infected with foot-and-mouth disease, or scraps of other food that had been in contact with them, Geraldine's happy-go-lucky method of feeding could easily have led her to pick up the virus, and another outbreak of foot-and-mouth disease would have been confirmed. It all goes to show that farmers must take precautions to ensure that their animals cannot get at unboiled waste foods.

(*Text and photographs from* Photoguide Magazine, *by kind permission of Mr. Thomas Langley.*)

Seed Potatoes from your Own Farm

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and
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Work at Efford and Rothamsted has shown that healthy seed potatoes can be produced in southern England. They cost much less than new certified seed; and first earlies especially produce a considerably earlier crop.

MANY growers will have heard recently about the idea of growing their own seed, but only a few will be familiar with its details and even fewer will have tried it. Potato growers, generally, are concerned about the high cost of seed, and it is partly because of this that a method of producing healthier seed in ware-growing areas has been sought at Rothamsted and Efford Experimental Stations, and at other centres in England, since 1950.

The yield of crops grown from seed saved from ware crops in southern Britain usually declines because each year an increasing proportion of tubers become infected with viruses, mainly leaf-roll and virus Y (causing rugose or severe mosaic), both of which are spread by aphids. Infection may pull down the yield of individual plants by 45–70 per cent, and any substantial number of infected plants therefore means a much smaller crop. Because of this, growers rarely save seed from the ware crop for more than one year, and it has been normal practice to buy new seed from upland areas of northern Britain or from Ireland, where viruses spread less because the climate limits the activities of the aphids. To produce healthy potato crops in the south, there must be freedom from aphids.

The experiments were designed to find out whether modern persistent insecticides will control aphids and so allow production of reasonably healthy seed in southern England; what spraying programme is necessary; what increased benefit is obtained by roguing in addition to spraying; the yield of seed potatoes obtainable, the cost of production and the economics; and how long a healthy stock can be retained.

We do not intend to describe here the results of the experiments in detail, but shall draw conclusions from them and make recommendations for the grower.

Choice of parent seed, planting, spraying and roguing

How long a stock of potatoes can be used depends on the proportion of infected tubers in it at first, and on the rate at which viruses spread in the crop. It is obviously desirable to start with the healthiest possible stock, namely S.S. The experiments suggest that starting with such seed, and with thorough spraying, stocks may sometimes be kept for up to ten years. The

* Now at the Glasshouse Crops Research Institute, Littlehampton.

extra years of life that may result will more than compensate for the extra cost of the S.S. seed. In the absence of any evidence to the contrary, planting should be at the normal season for the type. The seed crop should be grown in land prepared and fertilized as for the ware crop, and planted at 10 inches (earlies) or 12 inches (maincrop) in the row and at standard distance between rows, because the tractor and sprayer must be allowed room to travel without damaging the crop unduly.

All the experiments have shown that a correctly timed and efficiently applied insecticide will destroy aphids in the crop, and so prevent the spread of leaf-roll and, to a less extent, virus Y, from plant to plant within the crop. Viruses may still be introduced from other infected potato crops in the district, because incoming aphids may infect plants in the sprayed crop before being killed. For this reason, it is best to keep the seed crop as far as possible from other potatoes.

The results at Efford illustrate the control of virus spread obtained by insecticidal spraying. A stock of the early variety Ulster Prince, which has been sprayed each year and kept for seed since 1954, still had only 2·2 per cent of its plants infected in 1959. This represents no more than 1 per cent crop reduction in 1959 from this six-year-old seed stock.

For spraying to be successful, the foliage must be covered with insecticide, and to achieve this both down-nozzles and drop arms fitted with underleaf nozzles should be used on the spray-boom. Spraying must begin when 75–100 per cent of the plants have emerged, and should be continued at 14-day intervals. On average, four or five applications are adequate, but the first three sprays have the most effect. For all but the first application, 18 per cent DDT emulsion at 9 pints an acre (=2 lb active ingredient per acre) is a most satisfactory and economical insecticide for this purpose. Experiments have shown that low-volume application (25 gallons an acre) is as satisfactory as high volume. As drop arms to provide underleaf cover cannot be used for the first application, and DDT applied from above may not control aphids adequately, a systemic insecticide such as demeton-methyl at 12 fluid ounces to the acre is recommended.

Removing any infected plants from the seed crop will decrease the risk of spreading virus. All potato growers should learn to recognize the symptoms of the important virus diseases so that they can rogue their crops. Provided roguing has been properly done, so that *few, if any, infected plants remain in the crop,* the later sprayings can be omitted from the programme.

Virus does not spread much within a maturing potato crop because the plants resist infection, but it may occasionally be introduced by visiting aphids. The shorter the time the haulms are above ground, the smaller is the chance of this happening, and it might be worth while to destroy the haulms early when most tubers are seed size. There should not be more than three weeks between the last application of insecticides and destroying the haulms, otherwise the haulms may become colonized by aphids. When the haulms have died off, the crop can be lifted and sorted into seed, ware and chats. The seed should be placed in potato trays, and stacked until October in the field (or elsewhere in the open) to ripen. It should then be put into store—still in the same trays. In this way the seed need never be removed from the trays, which can later be taken to the chitting house and from there to the field for planting the following season.

Yield and cost of production

Clearly, unless seed can be produced for less than the purchase price of new certified seed, the effort would not pay. The investigations have, therefore, included detailed cost studies, which have shown that yields of 6–9 tons of seed per acre are usually obtainable at a cost of £12–16 per ton according to the yield, even after taking into account the profit which the land might have produced under another crop. This is substantially less than the present cost of new certified seed.

An equally important factor is that, with first earlies, home-produced seed is acclimatized, and experiments at Efford have shown that it will yield 4 tons an acre about twelve days sooner than new certified seed. Think how much the price of early ware potatoes can fall in twelve days; this makes the economic advantages of home-produced seed for earlies even more obvious.

In short, there is ample evidence that healthy seed stocks can be produced in many parts of southern Britain with the aid of insecticidal spraying alone, or better still spraying and roguing. Such seed is much cheaper than new certified seed, the greatest difference being with first early varieties. Home-produced seed of first earlies yield a much earlier crop.

For home production of seed to be successful it cannot be over-emphasized that the practices described, in particular the spraying programme and the actual rates of application, must be followed precisely. Half measures will fail and will discredit a worthwhile technique. Growers intending to produce their own seed are strongly advised to seek advice from their local N.A.A.S. officer.

Because of the success of the main investigations, and the considerable interest shown by growers, experiments on further aspects of the problem are already under way at Efford, and others are planned. These include the effect of parent-seed size and spacing on yield of seed; further comparison of the rate of bulking of home-produced and new certified seed of first early varieties; the use of systemic insecticides in the soil as a possible alternative to spraying; the influence of irrigation on the seed crop; and the treatment of seed between lifting and planting.

Manuring the Pea Crop

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Potash, properly applied, is the most useful of the three main plant foods for peas. Phosphate application is often justifiable only as a means of providing fertilizer "condition", while nitrogen often has no other effect than to improve the appearance of the crop.

UNTIL about fifteen years ago the manuring of peas had received scant attention. Since then, however, several important series of experiments have been completed which have helped us to establish the crop's requirements and the most suitable methods of fertilizer application.

Summarizing the results of a long-term rotation experiment with vegetable crops in which peas were included twelve times in sixteen years, Woodman reported in 1951 that "peas show a marked insensitivity to manurial treatment other than potash, and that, in particular, nitrogen in dung (that is, a basal dressing of slowly-available nitrogen) or in a top dressing (quickly available) has no very great influence on yield". These findings have been confirmed by another extensive series of experiments on threshed peas, conducted in 1946–49 in the eastern counties on a wide range of soil types with different fertility levels.[1] In the latter experiments the average yields from fertilizer dressings broadcast on the seedbed shortly before or after sowing were:

	Yield of threshed peas	Responses to higher rates of fertilizer. No. of experiments giving an	
	cwt per acre	*Increase*	*Decrease*
NITROGEN (N)			
Nil	16·5	—	—
1 cwt sulphate of ammonia (22½ lb N) per acre	16·5	—	—
2 „ „ „ „ (45 lb N) „ „	16·3	12	13
PHOSPHATE (P)			
Nil	16·1	—	—
2½ cwt superphosphate (56 lb P_2O_5) per acre	16·6	—	—
5 „ „ „ (112 lb P_2O_5) „ „	16·5	12	13
POTASH (K)			
Nil	16·0	—	—
1 cwt muriate of potash (67 lb K_2O) per acre	16·6	—	—
2 „ „ „ „ (134 lb K_2O) „ „	16·6	20	5

Potash more important than phosphate

Average yield responses to nitrogen and phosphate were negligible, and the number of experiments showing gains was offset by the number showing decreases.

With potash, there were twenty yield increases and five decreases, and although the average response was small, gains in individual experiments were much larger where soil analysis before fertilizer application showed the soil to be low in readily-available potash:

Readily available potash as shown by soil analysis	No. of experiments	Average extra yield from 2 cwt muriate of potash
		cwt per acre
Low	7	2·1
Medium	5	0·3
High	13	−0·1

Of the three main plant foods, potash is the most important for peas, and soil analysis provides a useful guide to the amount required by a particular field.

On the basis of these experiments there is little chance of a yield increase from phosphate unless the soil is acutely deficient in readily-available phosphate. However, straight potash is not easy to apply, so in the event of potash deficiency, as indicated by soil analysis or knowledge of past manuring, there is a good case for using a potassic-superphosphate compound with a high potash content. The phosphate gives the necessary "condition" and remedies any possible deficiency.

Nitrogen wasteful

Basal dressings of nitrogenous fertilizers usually seem to be wasted on peas, probably because the crop, being a leguminous one, is able to obtain its nitrogen from the air through the bacteria in the root nodules. More recent experiments have also shown negligible effects from nitrogen on rate of maturity of vining peas, and on yield and length of straw.[2, 3, 4]

In reviewing the results of experiments to date, it was tentatively concluded by Boyd in 1946 that "it is doubtful whether the use of nitrogen will give any increase in yield, although it usually improves the appearance of the crop in the field". This has been borne out by experiments since, and suggests that the main effect of nitrogen as a basal dressing is a psychological one. Nitrogen may make the crop *look* better, especially after a check by adverse weather or a pea weevil attack, but this is seldom accompanied by increased yield or other desirable characteristics, compared with peas receiving no nitrogen.

The Survey of Fertilizer Practice 1957 revealed that in five out of eight districts where peas for human consumption are widely grown, at least 40 per cent of the pea acreage received 15–60 lb nitrogen per acre; in two districts over 70 per cent of the acreage was treated. This nitrogen could have been used more profitably on other crops which are known to respond to larger dressings than are normally given at present.

Despite the foregoing, however, it is noteworthy that, in one series of experiments,[1] gains from nitrogen appeared to be associated with above-average rainfall in March or April, and it therefore pays to give peas a light dressing of a nitrogenous fertilizer (for example, ½–1 cwt sulphate of am-

monia or the equivalent) when sowing is done after prolonged wet weather in the spring.

Sideband placement

To secure the greatest benefit from fertilizers, it is important to use the most efficient method of application according to circumstances. Peas are a short-season crop which do not develop an extensive root system, and this implies that plant nutrients must be put in the root zone for maximum effect. Seven years' experimental work, done by Rothamsted Experimental Station and extended by the National Agricultural Advisory Service,[5, 6] demonstrated that the most profitable method of application for wide-drilled crops was placement in a band about two inches to the side of the seed and one inch below it. Average responses to 2–3 cwt per acre of potassic-superphosphate mixtures applied in this way were:

		Threshed peas	Green peas (shelled)
		Yield in cwt per acre	
Approximate yield increase from:	Sideband placement	2·7	3·1
	Broadcasting	0·8	0·6
Approximate *extra* yield from sideband placement over broadcasting		1·9	2·5
No. of experiments		30	13

Band application necessitates the use of a combined seed and fertilizer placement drill. A number of makes are available,[7] and the outlay is fully justified on fertilizer-responsive land where peas, and other short-season row-crops that benefit from sideband placement, are regularly grown. With more limited acreages it is possible to adapt existing combine or seed drills at much less expense, the cost quickly being repaid by the additional profit that may be expected.

Other methods of application

In the United States, experiments have led to "pre-drilling" being recommended as the best alternative to sideband placement. In this method the fertilizer is put 3–4 inches deep by combine drill, the seed being sown separately, but more shallowly, with the same drill. Responses have been comparable to those given by sideband placement, and there is no need for a special placement drill. However, limited experiments in Britain have shown the technique to be no more effective than broadcasting, although it can be recommended on land devoid of ridges and furrows where the tilth is fine and deep. Under the rough seedbed conditions that frequently obtain in this country, the coulters cannot remain at a uniform depth and, as a result, much of the fertilizer is scattered on the surface or applied too shallowly so that it comes into contact with the seed, when sown, with adverse effects on germination.

Most placement drills will not operate at a narrow row width[7] and, in any

event, clods and trash would tend to build up in front of the closely-spaced coulters. For narrow-drilled crops, where sideband placement or pre-drilling is not feasible, investigations have shown that fertilizer may be applied safely in contact with the seed with a combine drill, provided the following precautions are observed:

1. Use a no-nitrogen compound, in granular form.
2. Apply not more than 50 lb K_2O per acre (for example, 2 cwt 0–10–20) and drill in rows not over 9 inches apart.
3. Make sure seed is treated with a captan or thiram fungicidal dressing.

The least efficient method of fertilizer application is broadcasting, twice the dressing being necessary to achieve a response similar to that given by the other methods. Compared with broadcasting, however, the more effective techniques of application at half the broadcast rate are likely to produce responses at higher soil phosphate and potash levels.

Fertilizer broadcast on the seedbed close to sowing time is wasted. To take full advantage of this method, the dressing must be applied to the ploughed land some days before seeding, and then put about four inches below the soil surface by shallow ploughing-in or fairly deep seedbed cultivations.

Applications of nitrogen, phosphate and potash appear to have an insignificant effect on the rate of maturity of vining peas[4] and on the texture of threshed peas canned as "processed" peas.[5] Differences in colour, chemical composition and nutritive value due to these plant foods are also likely to be unimportant.

Summary of recommendations

Field manurial history, or soil analysis where the past manuring is uncertain, can provide a useful guide to the fertilizer requirements of the pea crop:

Guide to amounts of plant foods needed per acre of peas on basis of previous manuring or soil analysis

(These rates are for sideband placement, pre-drilling or combine drilling, subject to a maximum of 50 lb K_2O per acre in the case of combine drilling. For broadcast application, they should be doubled.)

Readily-available soil potash (K_2O) level	Readily-available soil phosphate (P_2O_5) level: Medium or above		Low		Very low	
	lb P_2O_5	lb K_2O	lb P_2O_5	lb K_2O	lb P_2O_5	lb K_2O
High	0	0	20	0	40	0
Medium	0	30*	20	+ 30	40	+ 30
Low	0	50	20	+ 50	40	+ 50
Very low	0	80	20	+ 80	40	+ 80

* Nil if broadcast

On the basis of the above table, recommendations have been made[9] covering (a) rates of application of straight fertilizers and potassic-superphosphate compounds with suitable PK contents, (b) examples of NPK compounds which can be partially or completely substituted to give the equivalent of 10 lb (20 lb if broadcast) nitrogen per acre following heavy rainfall in the spring, and (c) methods of application according to soil conditions and PK status, and fertilizer application machinery available.

For *wide-drilled crops* sideband placement is advocated. On level land with a fine deep tilth, pre-drilling is the next best method. For *narrow-drilled crops*, combine drilling is advised, subject to a maximum application of 50 lb K_2O per acre.* If more is justified, twice the balance should be broadcast using the method described below, or the dressing can be pre-drilled if soil conditions allow. If a sideband placement or combine drill is not available, the fertilizer should be broadcast on the ploughing at double rate, and put below seed level by suitable cultivation.

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* Combine drilling is generally impracticable for wide-drilled crops because, for a given rate of fertilizer, there will be approximately twice the amount per length of row compared with a narrow-drilled crop. This means that only 20–25 lb K_2O per acre can be combine-drilled with safety in wide rows, a rate much below that normally required.

Oxford Farming Conference

4–6th January

B. CRACKNELL, B.SC.(ECON.), PH.D.

About 850 people, a record number, attended this year's Oxford Farming Conference. A few of the older members who had attended the first conferences, before the last war, regretted the loss of intimacy since those days; but the rapid growth of the Conference has in itself been the measure of its success, and certainly a tribute to the energy and enthusiasm of its Secretary, Michael Soper.

THE theme of this year's Conference was "Capital—and how to use it". MR. H. H. THACKSTONE, Assistant Chief General Manager of the Midland Bank, remarked in his after-dinner speech: "I would be happier talking about 'Capital and how to *get* it'." However, he quoted figures showing that bank advances to farmers had increased by £68m. during 1959 to a record level of £312m. in November 1959, and concluded that getting hold of capital was no longer a problem! Such a remarkable change of attitude in so short a time is certainly bewildering. It is hardly surprising that several speakers in their papers, and others in private conversation, expressed the fear that bank credit was now becoming altogether too easy to obtain.

The banks' new policy was described by one farmer as a "revolution", and this word cropped up so often during the Conference that it became the dominant theme. MR. GEORGE WARDROP of the *Farmer and Stock-Breeder*, in his paper "Farm Mechanization Today and Tomorrow", described the changes now taking place in farm equipment and organization as a "silent revolution", and several later speakers took up the theme in their description of the new practices now being adopted. MR. A. ROSEN of Sussex, for instance, in a paper on the forage harvester, forecast that within two years 90 per cent of the silage crop, and 50 per cent of the hay, would be made with the help of this machine.

But the most remarkable "revolution" referred to during the Conference related to an altogether different aspect—the future of the landlord-and-tenant system. MR. P. W. TRUMPER, partner in a firm of chartered surveyors responsible for the management of some 500 farms let to tenants, declared that "the landlord-and-tenant system is entering upon a golden age, the like of which we have not seen since 1870". His paper was full of interesting and valuable statistics. For instance, when one of the farms managed by Mr. Trumper's firm becomes available for letting, between 100 and 300 inquiries and some 25 to 60 firm tenders are received, and in one recent case only 13 out of 57 tenders were for rents of less than £5 per acre. Mr. Trumper said that as a result of the 1958 Act, the landlord could now equip and maintain his estate adequately by fixing economic rents, and was again able to play his full part as the partner of the farmer in the business of agriculture.

He was speaking as a landlord, and it was therefore particularly interesting to hear MR. J. G. S. DONALDSON of Wotton-under-Edge, Gloucestershire,

putting the farmers' point of view. His theme was that there was nothing sacrosanct about the landlord-and-tenant system. There were many young men who had the "go" but not the "dough", and who found it impossible to enter farming. What was needed was a new kind of approach, based on the idea of partnership between such a man, who would invest his youth, energy and ambition, and an older man who would invest his capital and experience. Mr. Donaldson outlined the scheme in some detail, but he emphasized that it was merely one possibility among many one could think of. The main object of his paper was to encourage people to look at the problem of new capital for agriculture "not through lenses tinted with the landlord-tenant relationship, but through plain glass spectacles".

An evening session was devoted to a discussion on "Electronics—their Future in Agriculture". Here, for the first time in the Conference, the "boffins" were really given their head. We watched a demonstration of an electric fan controlled merely by breathing on a printed circuit, saw automatic time switches in operation, and watched a prototype driverless tractor steering itself along an imaginary pre-set course and giving a warning "snort" when any object crossed its path. But these were almost commonplace beside the description of a new technique now being explored for a pilotless aerial sprayer operated by remote control from the headlands. This surely is the ultimate in gadgets. Unfortunately, no demonstration of it was possible.

The last day of the Conference was devoted to severely practical papers. Mr. P. K. Crow of Shrewsbury spoke on rotary cultivation, Mr. P. Ainscough of Wigan on barn hay drying, and Mr. W. T. A. Rundle of Ringwood, Hants., discussed the disposal of dung and urine in intensive systems. These stimulated a ready flow of questions from the floor, and were well received. But the Conference is now a forum for the exchange of views of a more general and far-reaching interest to the farming community as a whole, and the time devoted to purely technical papers should be limited.

So much for the meetings and papers, but these do not complete the story. The snatches of conversation over lunch in Worcester College, in the bar at the Randolph Hotel, or during the coffee breaks between papers are vital ingredients of a successful Conference. It would be sad indeed if it grew to such a size that this element of personal contact was lost. Happily the change of venue from the Playhouse to the Town Hall has not in any way been symbolic of a change in the character of the Oxford Farming Conference!

Cereal Varieties for 1960

SEVERAL new cereal varieties are recommended by the National Institute of Agricultural Botany. Condor is a new Dutch spring oat which is the first for nearly ten years to give substantially heavier yields in trials than Sun II or Blenda, with shorter straw and large grain. Manod, another new oat, has marked resistance to mildew, crown rust, and oat stem eelworm, which makes it of special value in the south-west and west. In disease-free trials the yield of Manod has been somewhat below Sun II, but where these diseases were prevalent the yield of Sun II was usually lower than Manod. This wheat was bred by the Welsh Plant Breeding Station, and seed supplies will be limited this year. Of the older varieties, Maldwyn is recommended as a little earlier and does well on less fertile soils; Milford is renowned for its eelworm resistance and very stiff straw, though the yield is generally rather lower. Twelve other varieties of oats included in trials up to 1959 did not give sufficiently high performances to justify recommendation.

Among the spring wheats, Jufy I and Koga II remain the highest yielding, but with grain of no more than moderate quality. Koga II is now given a general recommendation. Phoebus is a new recommendation; it gives heavy yields of grain suitable for biscuit-making and is likely to replace Peko, which is transferred to category O—varieties becoming outclassed. Svenno gives good yields of good bread-making quality grain and is a much earlier maturing variety than Atson. Atle is recommended for special use where resistance to sprouting and high quality grain are more important than the highest yield. Looking ahead to winter-sown varieties, Professor Marchal is newly recommended as heavier yielding than Cappelle Desprez, with short, fairly stiff straw and grain of the hard milling type. Elite Lepeuple is another new recommendation giving good yields of high milling quality and good bread-making characteristics. Minister and Dominator are transferred to the "becoming outclassed" category.

There are no changes in the spring barley list, except that after a number of years in the "becoming outclassed" category, Herta disappears. The Institute considers that Rika fills the same agricultural need for a very heavy yielding, feeding barley, and that there is no need for both varieties. Proctor remains the highest yielding of the malting barleys, whilst those wanting earlier maturity can use Maythorpe or Earl. For those seeking later maturity than Proctor, Provost is available. Freja is an early-maturing barley mainly used for feeding.

There are no changes in the recommended lists of winter oats and barleys.

The full recommended lists can be summarized as follows, varieties being printed in order of probable yield under average conditions:

Spring Wheats		*Spring Barleys*		*Spring Oats*	
Jufy I	N	Rika	G	Condor	N
Koga II	G	Proctor	G	Blenda	G
Phoebus	N	Carlsberg II	O	Sun II	G
Svenno	G	Freja	S	Manod	N
Atson	G	Provost	S	Maldwyn	G
Peko	O	Maythorpe	S	Milford	S
Atle	S	Spratt Archer	O		
Fylgia II	O	Earl	S		
		Plumage Archer	O		

CEREAL VARIETIES, 1960

Winter Wheats		*Winter Barley*		*Winter Oats*	
Professeur Marchal	N	Pioneer	G	Penrhyn	N
Cappelle Desprez	G			Powys	G
Flamingo	N			S.147	G
Minister	O			Picton	O
Hybrid 46	G			S.172	G
Elite Lepeuple	N				
Banco	G				
N.59	S				
Dominator	O				
Milfast	N				
Squarehead's Master	O				

G = General use
S = Special use
N = New recommendation
O = Becoming outclassed

New editions of the Institute's Farmers' leaflets incorporating these changes should be available early in February, together with new leaflets on field beans and varieties of grasses. They may be obtained by sending a stamped addressed envelope to the Secretary, National Institute of Agricultural Botany, Huntingdon Road, Cambridge, saying which leaflet is required. Copies are being sent to all Fellows of the Institute.

Speaking about Milk

The Report of the Production Division of the M.M.B., 1958–59

K. Hills Bond

Total milk supplies dropped heavily in 1958–59, for the first time since 1951–52. Cow numbers and individual yields both fell. There was a change in the financing of milk recording, and artificial insemination continued to spread.

The Production Division of the Milk Marketing Board has published its ninth report* the period covered is April 1958 to March 1959, an interesting and eventful year in milk production, and a proud one for the head of the division, Dr. Joseph Edwards, who was awarded the Thomas Baxter trophy. The division works mainly in the field of milk recording and artificial insemination, but the introductory pages of the report deal appropriately with milk production in the year under review. The outstanding feature of the year was the sharp fall in total milk supplies, sharper indeed than in any two consecutive years in the history of the Board. This was accounted for by the drop in total cow numbers, as well as a fall in milk yield per cow during the latter part of 1958 and the early months of 1959. There were several causes for this dual influence on total milk supplies, which turned downwards for the first time since 1951–52.

* Milk Marketing Board. Report of the Production Division, No. 9. 1958–59. Available from the Secretary, Milk Marketing Board, Thames Ditton, Surrey, price 7*s.* 6*d.*

The fall was steep and severe. There were 80,000 fewer cows in March 1959 than a year previously, and the yield per cow declined from 745 gallons in 1957–58 to 720 gallons in 1958–59. A firm demand for beef animals, and the speeding of the last stages of eradication of bovine tuberculosis, caused the culling of animals and disposal of herds without full replacements, and the further fall in the total number of producers all helped to reduce the national herd. We cannot be sure why more producers gave up milk selling in the year, but presumably they thought that "milk was being overdone".

For the spectacular fall in supplies from June 1958, when they were at an all-time peak, to March 1959, a cause more significant than those to which the drop in cow numbers has been attributed is discussed. The prolonged wet weather until the end of 1958 led to poor quality autumn grazing. There had, of course, been difficulty in making good hay, and this in itself may have made dairy farmers rather reluctant to bring their stock in earlier than might seem necessary. Anyway, there was a strong and apparently irresistible temptation to keep cows out while the weather was open and there was an abundance of grass—poor though it may have been. If recorded herds are better managed than non-recorded ones, the reluctance to bring cattle in for full stall feeding would apply in still greater degree to the non-recorded and more numerous herds. The same is probably true of the observed failure to increase the concentrate ration to compensate for the poor quality of the winter fodder. The net result of these influences was the drop of average cow yield from 745 to 720 gallons.

Milk recording now privately financed

The salient feature of the year for the milk recording movement was the fact that it saw the end of an era in the way in which the movement is financed. At the end of the milk recording year 1958, the Ministry of Agriculture ended its grant after forty years of government support. From now on the movement will be financed jointly by the milk producers (Milk Marketing Board) and the membership, the latter contributing 86 per cent of the costs. There has been a further slight fall in the number (to 21,000) of herds enrolled in National Milk Records, while those enrolled in Private Milk Records remained about the same (10,500).

Artificial insemination continues to spread, though, of course, at a slower rate now that no less than 1,800,000 cows a year are inseminated at the twenty-two Board and seven non-Board centres. The use of beef and dual-purpose bulls as alternatives to pure dairy bulls, the facility which producers now have to nominate sires, and the progeny-testing of bulls greatly increase the scope and value of this revolutionary change in the breeding of the national dairy herd. It is to the good that while mixed herds ten years ago accounted for 22 per cent of all recorded herds, the corresponding figure now is only 8 per cent. I hope that a similar breed consciousness will be increasing in non-recorded herds. The expansion of the consulting officer service may have this among many beneficial effects of the work of these officers.

The investigations which have been carried out into feeding practices in recorded herds show that the functional concentration of the division on breeding matters has not excluded regard for the important influence which feeding has upon milk yields and the economics of milk production.

22. North-west Herefordshire

P. L. SCUDAMORE, N.D.A., C.D.A.
District Advisory Officer

KINGTON is an old-world market town on the western boundary of Herefordshire. To the north are hills marking the boundary of England and Wales. Before the war these hills, which are common lands, were infested with bracken; the drive for food production enforced cultivation, and since the return of the land to the commoners, associations have been formed and an effort made to maintain it for the grazing of cattle and sheep. From the golf course, 1,284 feet above sea level, can be seen the winding valleys of the famous fishing rivers Wye, Lugg and Arrow. To the east are the Malvern Hills, to the north-east the Clee Hills, to the west the Radnor Forest and Welsh Marches, and to the south-west the Black Mountains and Brecon Beacons which surround the county. The district is an eighteen-mile segment of a circle, centred at the golf course at Kington and extending from the river Wye in the south to Ludlow in the north. Fortunately, even in these times, no factories have yet encroached on the rural scene.

Many years ago, store cattle from the Welsh hills were brought to England along the Welsh Marches. A famous old inn—The Rhydspence—on the county boundary remains as a landmark; the drovers rested there for the night before continuing their journeys. The area is famous for its livestock, which are "exported" to all parts of the country. Among the sheep, the Clun, Kerry Hill and Radnor Forest breeds predominate, with very localized crossing. The draft ewes are sold, traditionally as two-year-olds, at the autumn sheep sales, an important economic event of the district. Most of the ewe lambs are put to the ram, and a 75 per cent lambing average from them is not uncommon. Only by this method is it possible to maintain a high output of two-year-old ewes for sale. Many wether lambs are finished off grass, but the folding of swedes remains the system most widely practised.

The importance of the swede crop (at 15–20 tons per acre) to the densely populated sheep farms is sometimes not fully appreciated. There is little other food available, particularly *in situ*, during the first three months of the year. Folding roots allows the concentration of large numbers of sheep on a small acreage—the land being in rotational cropping is in no danger of becoming sheep sick. The fertility of the land is improved by the golden hoof; pastures are rested to recover before they are restocked with ewes and lambs in the spring. Precision drilling of fodder crops has recently been developed, reducing the cost of growing roots for folding.

Hereford cattle, or crosses with the dairy breeds, are found on most farms. Pure-bred Herefords are reared by single suckling: many are sold as stores, either at the autumn suckler sales or as "three-half-year-olds". They command a good market to go to the fattening pastures, or for yarding in other

parts of the country. Some richer pastures, on the Herefordshire plain, are found to be unsuitable for rearing, and on these pastures large numbers of cattle are finished. Multiple suckling is also an important feature; up to six calves per cow are reared, these stores being sold as yearlings or two-year-olds.

There are some notable pedigree Hereford herds in the area, bulls of the highest quality being bred. The September Kington Agricultural Show is an excellent preview of young stock, particularly Hereford cattle, Clun and Kerry Hill sheep. The winners expect to collect rosettes at the major summer shows the following year.

Dairy farming is practised throughout the district, except on the higher land, which is devoted to rearing. Many of the cows are crossed with a Hereford bull, calves finding buyers when sold in local markets. In some cases it is the practice to cross all the cows with a beef bull, dairy replacements then being purchased either as calves or bulling heifers.

These dairy farms are rarely without a sheep flock, which in recent years has contributed handsomely to the farm profit. These flocks, some of which are pedigree, are not scavengers, as they would be on dairy farms in some other parts of the country. They run the outskirts of the farm, still following the dairy cows to keep the pastures in good condition, and are invaluable in establishing swards when reseeding.

The upland farms are on Silurian limestone, the lower land overlying Old Red Sandstone. The rich, red, lowland soil is capable of producing a diverse range of crops. Some hops are grown on the heavier land, yet the soil can be made friable enough for a small acreage of soft fruit. The acreage of black currants has increased in recent years, and exceptional yields, up to five tons an acre, have been achieved. The recent development of dalapon for couch control has enabled growers to reduce the amount of hand-work in cleaning around the black currant bushes, and the plantations are well maintained.

Cider orchards are a notable feature of Herefordshire, but in this district they range from those regularly sprayed and pruned to paddocks—the trees providing little more than shelter for livestock.

Wheat and barley are the main arable cash crops and, with a 3- or 4-year ley, form the basis of the rotation. Yields of wheat and barley reach two tons an acre, and hay from leys often produces 45 cwt per acre. The investment in machinery is high on these lowland farms, and this helps to retain keen young workers on the land.

Permanent pasture or long leys are favoured for fattening cattle; the consistent growth of herbage throughout the season has been found more advantageous than the lush growth of the young ley. Beef production does not warrant a too liberal use of high-cost fertilizers; great reliance is placed on potash and basic slag. Set stocking is usually the method adopted. At least one store beast per acre is put on the pastures in the spring, and these, when selected fat, are replaced by other stores through the summer. Sheep are brought on to these pastures to a limited extent from time to time.

Both farmers and farm workers share a great pride in livestock. The skill of these men is well illustrated by the high standards attained at the many competitions for farm skills arranged each season in this and neighbouring districts.

At the Farmers' Club

Problems of Feeding Additives to Farm Livestock

In reviewing some of the thornier problems associated with the use of additives and implants in livestock production at the Farmers' Club on 13th January, Dr. R. Scarisbrick of the Agricultural Research Council left his audience with rather more questions than answers. This, he said, is inevitable where existing evidence is not sufficient to point to a definite conclusion. Nevertheless, we may have to reach a decision. Though this is an administrative matter, science can help by pointing out factors that must be taken into account. Dr. Scarisbrick illustrated this by reference to the extensive research which has been done on growth-promoting agents for farm livestock.

Dr. Scarisbrick mentioned methionine as a good example of a food additive in which, so far as is known, only the economic factor has to be considered. It is fairly expensive, but ½–1 lb of synthetic methionine added to each ton of broiler food gives an increase in the food conversion rate worth three to four times the cost of the additive. The bird's need for methionine increases with growth rate, so that with high energy rations, supplementation is both more necessary and more worth while.

Unlike methionine, copper, which is cheaper, is toxic. Recently it has been realized that sheep may be poisoned by excessive consumption of mineral mixtures of supplements containing copper. Poisoning by copper has been reported in pigs, and also occurs in other animals, though more rarely than in sheep. Work at the National Institute for Research in Dairying has demonstrated that pigs fatten faster when copper is added to their diet; 250 parts per million of copper sulphate has been suggested. Bearing in mind the hazards of copper poisoning, Dr. Scarisbrick suggested that as half this rate is still effective, it would be wiser to regard 125 parts per million as a maximum till more experience has accumulated.

With arsenic compounds, which are used against coccidiosis and as growth promoters for pigs and poultry, in concentrations varying from 25 to 250 parts per million, the question of toxicity to the consumer arises. Fortunately, the arsenic content of meat falls rapidly when the feeding of arsenical additives ceases. "The recommendations of the American Federal Food and Drugs Administration to the effect that the feeding of these additives should be stopped a few days before slaughter seems very wise," said Dr. Scarisbrick, "especially as the maximum arsenic content of foodstuffs is fixed by law in this country." With synthetic oestrogenic hormones, the issues are more complex. Wrongly timed or incorrect doses can upset an animal's delicately balanced endocrine system. Although the dangers to a man handling the concentrated material are well understood by producers and compounders, it is better that concentrated pre-mixes for home mixing should not be available for farmers.

Much research has been devoted to tracing hormone residues. Using biological methods, American workers have shown that there is less than 1 part per 10 million of stilboestrol in the edible parts of sheep and chicken after hormone treatment, and only one-tenth of this amount in beef muscle and liver. Very sensitive tests for detecting radioactive hexoestrol have shown here that only very small amounts are to be found in the bodies of implanted animals—far too small to have any oestrogenic effect on normal people.

Considering the fate of synthetic oestrogens excreted by treated animals (only a very small amount, say 2 per cent of an oral dose, is retained), Dr. Scarisbrick mentioned experimental work that confirms the existence of soil bacteria able to break down the hormones. So the life of hexoestrol in soil may not be long, nor does it seem to be taken up by those plants tested so far, though there are signs that it sticks rather tenaciously to plant leaves.

But while doubts remain about the possibility of these materials causing cancer, a cautious attitude towards their use prevails both here and overseas. In America, no new licences for incorporating synthetic oestrogens into feed are being granted. In 1959, France prohibited the sale of such feedingstuffs and of treated meat or animals for human consumption. In Sweden, hormones for fattening cattle have been banned for the time being.

If the natural hormone oestradiol could be produced cheaply, it would probably soon become very popular, for many of the problems associated with the synthetic hormones would no longer arise. Of the two synthetic materials, hexoestrol is preferable to stilboestrol as it is less toxic to man.

The difficulties with antibiotics are connected with their effects not on man but on the multitude of micro-organisms intimately associated with animals and birds, especially those in the gut. An enormous amount of work will be necessary before this infinitely varying and constantly shifting situation can be pictured even in outline. Antibiotic supplements are most effective when production is lowest. But do we really want to encourage production from the poorer flocks of hens? Antibiotics have increased the growth rates of runt pigs by as much as 200 per cent. Might not antibiotic feeding introduce an unwanted bias into a breeding programme? Is antibiotic feeding the lazy man's route to better production, by-passing good management?

Too little is understood about the development of resistant strains of bacteria when an antibiotic is used continuously, and about the subsequent loss of resistance when treatment ceases. "Everyone will balance the advantages and disadvantages of the use of antibiotics in feed in his own way," said Dr. Scarisbrick. Meanwhile, the restriction of narrow-spectrum antibiotics for feeding, leaving the broad-spectrum ones for therapeutic uses, as suggested recently by the Ministry of Agriculture's Chief Veterinary Officer, forms a useful compromise.

Selenium, recently in the news as a possible food additive, may not be profitable here except in a few small areas. The Agricultural Research Council is encouraging research into the problems involved in its use. Until this is finished, Dr. Scarisbrick said, he hoped that the enthusiasm of those who would like to see immediate practical advantage taken of the discovery will be tempered by awareness of the toxic hazard; for the toxic dose (less than 1 part per million) is very close to the useful dose (less than 0·1 p.p.m.).

Sylvia Laverton

THE MINISTRY'S PUBLICATIONS

Since the list published in the January 1960 number of AGRICULTURE (p. 472) the following publications have been issued.

MAJOR PUBLICATIONS

Copies are obtainable from Government Bookshops or through any bookseller at the price quoted.

BULLETINS

No. 174. Poultry Nutrition (*New*) 5*s*. (5*s*. 6*d*. by post)
In this new bulletin the author, Dr. W. Bolton of the Poultry Research Centre, Edinburgh, discusses energy metabolism and puts forward a new method of assessing the energy value of diet, based on his own experimental studies. Also discussed are the quality of the proteins and the vitamin and mineral balances of the diet.

No. 179. Seedlings of Common Weeds (*New*) 4*s*. 6*d*. (5*s*. by post)
A new, fully-illustrated publication on the identification of the seedlings of common British weeds. To assist in identification, the seedlings have been divided into fourteen groups, in which the characters separating the individual species are given in detail and illustrated with a drawing to scale. Information on soil preferences, distribution and importance of each weed are also included in this non-technical guide for the general reader.

OTHER PUBLICATIONS

Agricultural Improvement Council, Fourth Report, 1956–59. (*New*) 2*s*. (2*s*. 3*d*. by post). A summary of the work in progress at the Ministry's Experimental Husbandry Farms and Horticulture Stations.

LEAFLETS

Up to six single copies of Advisory Leaflets may be obtained free on application to the Ministry (Publications), Ruskin Avenue, Kew, Surrey. Copies beyond this limit must be purchased from Government Bookshops, price 3*d*. (5*d*. *by post*).

ADVISORY LEAFLETS

No. 13. Apple Sawfly (*Revised*)
No. 61. Pea and Bean Weevils (*Revised*)
No. 88. Brown Scale (*Revised*)
No. 91. Mangold Fly (*Revised*)
No. 476. Chemical Weed Control in Horticultural Crops (*New*)
No. 478. Chemical Weed Control in Carrots and Parsnips (*New*)

FIXED EQUIPMENT OF THE FARM LEAFLET

No. 10. Buildings for Grain Drying and Storage (*Revised*) 9*d*. (11*d*. by post)

FREE ISSUES

Obtainable only from the Ministry (Publications), Ruskin Avenue, Kew, Surrey.

UNNUMBERED LEAFLET

Suggested Seeds Mixtures for Welsh Grassland (*Revised*)

In Brief

BOVINE TUBERCULOSIS AND FOWL PEST

The Minister of Agriculture spoke about bovine tuberculosis and fowl pest at the annual general meeting of the Leicestershire National Farmers' Union on January 13th. "In a few weeks time", he said, "we shall declare the last eradication area in Great Britain for bovine tuberculosis. If all goes well, the whole of the country should be attested before the end of this year, or at latest early next year. Many people have asked what the next steps are going to be in animal health when that job is done. This is a question to which we have been giving careful study. I cannot give you a final answer today, but the first point is that when the area eradication of bovine tuberculosis is done with, that does not mean that we can forget about the disease. In spite of the utmost vigilance, odd cases will turn up here and there, and we shall need all our care to prevent infection building up afresh. We shall have to keep on with periodical testing for a long time ahead, although we shall be able gradually to reduce the frequency of tests, especially in the older attested areas. Nevertheless the ending of area eradication will relieve the veterinary profession of much work.

"Where else can they concentrate their efforts? One of the matters which we have had under close review in this connection is pig diseases and especially swine fever. There is no easy answer and we shall need to consult a number of different authorities. But I shall make a statement as soon as I possibly can.

"We now have about 4,500 veterinary surgeons in the country compared with about 2,000 in the 'thirties. I would say that it is up to you farmers to see that the energies of this profession are fully used. There is tremendous scope for yet greater increases in agricultural productivity by using the help and advice of the private vet. This is especially true of the many things which call for individual treatment or preventive action on the spot.

"Obviously many of you are worried over the exceptionally heavy incidence of fowl pest since the beginning of last October. I certainly am; and the position is serious. During the first nine months of 1959, we had 540 outbreaks, and in the last three months, 1,522, making a total of 2,062 outbreaks for the year. Over 4 million birds were slaughtered under the Diseases of Animals Act, and the amount of compensation was round about £3 million.

"But bad as this is, we should remember that over a very large part of the country there has been comparatively little fowl pest, and in a good many counties no outbreaks at all. In recent weeks, the trouble has tended very much to be localized in East Anglia, particularly in Norfolk, with sporadic outbreaks elsewhere. This is still so. There are signs of a diminishing intensity in both Norfolk and Suffolk, and it may be that at long last we are really getting on top of the disease, but I cannot say whether we are yet well and truly round the corner."

NEW PRESIDENT OF THE NATIONAL FARMERS' UNION

Mr. Harold Woolley, C.B.E., farming 500 acres at Hatton Heath in the Cheshire Plain, has been elected as President of the National Farmers' Union in succession to Lord Netherthorpe. Mr. Woolley was born in Blackburn, Lancs, and went to Cheshire when he was eighteen years old. He is now fifty-four. He was Vice-President of the N.F.U. in 1948 and 1955, and Deputy President in 1949, 1950 and 1956. He has played a leading part in the formulation and prosecution of the

Union's policy on land use, particularly in connection with the open-cast coal problem, and on wages and all other matters affecting relations between the farmer and farmworker. He was one of the employers' representatives on the Agricultural Wages Board during 1947–58, and led the employers' side between 1953–58.

The main enterprise on Mr. Woolley's farm is a herd of 150 pedigree British Friesian attested cows, the milk from which is mostly sold through his own retail business as "farm-bottled T.T.". Mr. Woolley was one of the pioneers both in production of Grade A milk and in attestation of dairy herds. For many years his herd has been self-contained and, apart from bulls, every animal on the farm is home-bred. In addition to replacements for the dairy herd, he breeds about 40 beef-cross calves a year, which are sold either as stores or fed off grass at about two years old. A herd, usually about 50 strong, of Large Whites and Large White/Landrace cross sows is maintained for breeding pigs, which are fed to bacon weight. In recent years he has reduced the acreage of tillage crops and now only grows 30–40 acres of wheat a year.

Col. H. J. Wilson, O.B.E., T.D., who farms at Robertsbridge, Sussex, was re-elected Deputy President, and Mr. G. T. Williams, who farms in Shropshire, was elected Vice-President.

TWIN CALVES BY A.I.

Among Britain's scientific and technological developments recorded in *Commonwealth Survey* (Vol. 5, No. 25) issued by the Central Office of Information, reference is made to the possibilities of obtaining twin calves by artificial insemination.

"On 3rd November, Dr. Joseph Edwards, chief scientific adviser to the Milk Marketing Board, made public at a meeting at Llandrindod Wells the progress of experiments in the production of twin calves by artificial insemination. Three such calvings took place at Abermithel, near Penybont, Radnorshire. Though there was still much to learn, such as the amount of hormone needed at different seasons and the best forms of nutriment, it was felt that twinning in cattle could be artificially induced and that twins thus born would be normal. It had also been found that the technique could be used through the existing artificial insemination centres. Although the numbers involved in the experiment were small, the calf crop looked like being 120 to 125 per cent. According to Dr. Ian Gordon, of Cambridge University, who is in direct charge of the experiment, beef farmers are more keen on twin calves than dairy farmers, and the development could help to increase world meat production."

CARTRIDGE REBATE SCHEME TO END

In a written answer to a question in the House of Commons recently, the Minister of Agriculture said that the rebate on cartridges used for the organized shooting of harmful birds is open to abuse and will not be continued after the end of March.

He is anxious that harmful birds should still be shot, however, and is discussing with agricultural interests the possibility of extending the scope of the grants to Rabbit Clearance Societies to include expenses incurred in shooting such birds as wood-pigeons.

HYPOMAGNESAEMIA DANGER

The seasonal danger of hypomagnesaemia (also known as grass tetany, grass staggers and lactation tetany) is approaching. Make sure, therefore, that your animals get the necessary amount of magnesium in their diet. Information on suitable compounds of magnesium and advice on their use is given in the Min-

istry's Animal Health leaflet No. 49 (free from the Ministry's Publications Distribution Office at Ruskin Avenue, Kew, Surrey).

Spring pastures must be top dressed before the end of February if advantage is to be obtained from this treatment for 1960 grazings.

Immediately symptoms of hypomagnesaemia are observed (nervousness, restlessness, twitching of muscles and grinding of teeth), call in your veterinary surgeon.

Hypomagnesaemia can appear without warning and at any time of the year, but there are especially dangerous periods. The most important of these for dairy herds is early in the grazing season with the first flush of grass.

IRISH CATTLE AND BOVINE TUBERCULOSIS ERADICATION

From 1st March, imported Irish once-tested cattle must be isolated from cattle on neighbouring farms. Previously, such cattle had only to be isolated from other cattle on the premises to which they had been sent. This is the principal effect of an Order made jointly by the Agricultural Departments. A further requirement of the Order makes it necessary to obtain a licence before any Irish cattle are taken on to farms which are subject to movement restrictions imposed to control the spread of bovine tuberculosis.

WOODMAN, DON'T SPARE THAT TREE

The old exhortation "Woodman, spare that tree" finds no support by Mr. A. H. Harrison, writing in the current issue of the *Quarterly Journal of Forestry*. Those who cry this, he says, are so often terribly mistaken. "All life has a beginning and an end; in this the tree shares with us a common mortality. Just what have these kind mistaken people in mind for the tree that they have spared? They are prompted by the thought that a thing of beauty is a joy for ever. Does not beauty fade as fades the rose? Is this tree they would have us spare beyond sturdy middle age to be left to degenerate into a hideous old age, its lower limbs propped on poles like a cripple on crutches, its trunk girt with iron bands, like a lunatic's strait jacket, its upper limbs festooned with chains like a felon, its meagre leaf flush an utter parody of the once lovely foliage, like rouge on the face of a crone?

"Is this the fate for which the tree is to be spared? We are kinder to aged dogs, perhaps we would be kinder to the tree if it were articulate.

"Woodman, have you an axe to grind? Then grind, and then perform an act of mercy, and when you have burnt the litter, take your spade and plant a young tree in the old one's place. And those that like to may put up a notice: 'This tree is planted on the site of an older tree under whose branches Queen Elizabeth I had a picnic.' Then Woodman, good fellow, get you home and warm your feet at a fire made with the logs of the old tree."

Book Reviews

Soil, Grass and Cancer. ANDRÉ VOISIN. Crosby Lockwood. 30*s*.

In this interesting, stimulating but highly provocative book, M. Voisin relates the health of animals and men to the mineral balance of the soil, through the medium of the chemical composition of the vegetation it produces.

The effects of mineral elements in the soil and of certain fertilizer treatments on the organic, as well as inorganic, constituents of the herbage are briefly reviewed. Attention is rightly drawn to the very limited value of chemical analyses of feedingstuffs for assessing their actual food value for animals, and to the meagre information provided by soil analyses regarding the true availability of certain constituents to the plant.

The importance of dietary deficiencies of minerals, especially of the trace elements and of copper in particular, and the effect of these deficiencies on the metabolism of some of the body cells is discussed at some length. Most attention is given to tracing the association between variations in soil composition and metabolic disturbances of tissue cells, which induce those cells to adopt the cancerous "way of life". The correlation between the incidence of some types of cancer and certain geological formations in Wales, Holland and France is discussed, and the importance of nutritional factors for the prevention of disease, and especially of cancer, is stressed.

Since "all flesh is grass", not many would disagree that the nature and composition of the soil are of primary importance to the well-being of the flesh, but many may disagree with some of the evidence the author presents as proof of his hypotheses. It is difficult to accept some of M. Voisin's interpretations of the evidence he has selected to prove the relationship claimed between soil, plant, animal and human health. A number of the references to published work are quoted out of context, so that M. Voisin's interpretation is at variance with the author's deductions. Nevertheless, however much one disagrees with some of M. Voisin's evidence, there is no doubt that he is right to stress that "the soil must be kept in good health if the animal is to remain in good health" and that "soil science is the foundation of protective medicine, the medicine of tomorrow".

R.A.

Grazing Control: Laws and Regulations in Various Countries for the Control of Grazing to Prevent Injury to Grasslands. Compiled by A. G. G. HILL. Commonwealth Agricultural Bureaux. 7*s*. 6*d*.

Many governments throughout the world have made regulations to control grazing and prevent injury to grassland. An indication of the general objectives for which these regulations have been framed is contained in this twenty-seven-page, mimeographed booklet. The information is in alphabetical order and gives, in a convenient form, references to the various regulations, rules, orders, laws and ordinances in force in over sixty countries.

As stated in the introduction, this information is of most value to those "whose task it is to draft, or enforce, legislation or regulations for the control of grazing with the object of preventing temporary or permanent damage to pastures or rangelands".

The difficulties of preventing grazing abuses on public or common land vary enormously with the agricultural standards of the country, and the regulations range from limitation of numbers of stock to detailed control of management. The dominant theme appears to be the prevention of damage to grassland by overgrazing: it is perhaps worth noting that pastures may, on occasion, suffer equally from undergrazing.

At the same time, this publication serves to emphasize the fact that the achievement of better pasture is but the first step in grassland improvement, the permanence of which depends upon subsequent management.

C.R.W.S.

Relations between Water and Soil. T. J. MARSHALL. Commonwealth Agricultural Bureaux. 20*s*.

Any technical publication issued under the auspices of the Commonwealth Bureaux can always be regarded as an indispensable tool in the study of the particular subject discussed. This latest release is no exception.

For the first time, subject-matter relating to water as it affects agronomy and the growing of crops in all aspects has been collected together and presented in a precise, readable manner. The very first sentence, "Over a great part of the land surface of the earth, water limits plant growth either because there is too much or too little of it in the soil", strikes the right note and is the key to subsequent development.

There is much that will be of value to the grower, although the treatise mainly concerns the soil scientist, advisers on drainage and the growing of crops, and the research worker. A well thought out and seemingly natural sequence is followed in the development of the theme. After the function of the soil as a store for water has been described, the properties of the soil as they affect retention, distribution, movement, availability to plants and the accumulation and distribution of salts are successively dealt with.

The theories and associated mathematics of the various water relationships are adequately developed, and consequently occupy a considerable amount of space. However, for those readers who will not wish to delve too deeply, the mathematics can be disregarded without detracting from the argument.

A very extensive and up-to-date bibliography is included.

J.W.B.

Farming as a Career. RALPH WHITLOCK. Museum Press. 15*s*.

No reviewer can complain that a book is not what he wants, when he wants something the author had no intention of writing. There is, however, ground for fair criticism if a book's content belies its title. In a careers book like this, it is reasonable to expect more than a sixth of the 128 pages to deal with training and how to start. Yet, Mr. Whitlock devotes only twenty-two pages to these subjects—and fifteen of those are concerned with the raising of cash.

Having made that criticism, I would advise anyone in the early stage of an interest in agriculture to read this review of present-day farming methods. In it, a practical and intelligent man describes the essential character of arable farming, dairying, beef cattle projects, sheep and pig farming, poultry-keeping and market gardening, in as many chapters. A final dozen pages deal with pests and diseases.

To know that there is more than one type of milking parlour, that a cow's ration must be calculated and costed, and that sheep breeds can be classified as long-woolled, short-woolled and mountain, is useful. But such information ought not to crowd out of a book on *careers* a fuller description of a farmer's life among country neighbours, and of the varied means by which young men and women can acquire the knowledge and experience needed in the profession. How should they be encouraged to learn? (Not by telling them, as the second sentence in chapter one suggests, that a G.C.E. is necessary.) How can they make best use of what they are told by the skilled men with whom they may work as learners? Does the success of a young man's career in part depend, if he is married, upon the house that he takes with the farm? The author would, undoubtedly, have had some very useful remarks to make on such matters, but the book ignores them.

Mr. Whitlock has written a very pleasant and interesting book on farming; but its content does not live up to its title.

A.V.

Farming the Land. VICTOR BONHAM-CARTER. Routledge and Kegan Paul. 15*s*.

In his preface, the author says that his book "is intended for anyone of any age, who is curious about farming". Such a reader will certainly find this an informative and readable book, presenting a general picture of the growth and development of British farming from earliest times to the present day. The author is to be congratulated on condensing so much information into only 157 pages and on maintaining a good balance throughout.

In so far as this book may be read by the townsman, Mr. Bonham-Carter has

rendered a valuable service to the agricultural community generally by drawing attention to the value of agricultural land as one of Britain's greatest natural resources, not only at the present time but in the future, when the demand for the world's food supplies will have increased. He also bravely tackles the thorny problem of subsidies, and at least gives the non-farming reader and taxpayer food for thought as to who is really being subsidized.

Young readers, particularly, will find this a most useful book to give them a bird's-eye view of the history and development of the farming industry, whether their background is urban or rural. I hope that it will be brought to the notice of headmasters of grammar and secondary modern schools where pupils show any interest in agriculture or rural science.

There are a few technical inaccuracies in the text: for example, phosphates are *not* readily washed from the soil, and potato blight is *not* a virus disease. Also some of the illustrations may fail to convey accurately what they are meant to portray. On the other hand, the photographs are of a high standard, and the diagrams of a West Country farmstead give an excellent impression of the development of farm buildings and layout during the last hundred years.

W.E.

Diseases of Livestock (4th Edition). T. G. HUNGERFORD. Angus and Robertson. 75*s*.

As the author freely admits in the introduction to this fourth edition of his book, the energies of several authors would be necessary to keep up to date every aspect covered in the volume. Nevertheless, he has retained sole authorship, in an attempt to maintain "unity and touch", and in many respects has succeeded in compiling considerable information on diseases of livestock, particularly as they occur in Australasia.

The text shows a very wide range of knowledge, gained from both personal experience and the literature. Unfortunately references are few and, in general, limited to Australasian publications: it is to be hoped that a promised increase in subsequent editions will give a wider and more generous coverage.

Diseases of all the common domesticated stock except poultry are referred to, and most of the common diseases encountered in this country are mentioned, in addition to many which are rare and some which are restricted to Australasia. But the descriptions of diseases occurring in Britain sometimes differ from what would be expected here. For example, sudden death is recorded as a possibility in tetanus in sheep and, in the differential diagnosis table for the same species, cobalt deficiency is said to produce scouring; the list of points for differential diagnosis of swine erysipelas and swine fever shows a number of inaccuracies.

Most of the illustrations are a useful addition to the text, though they could be enlarged with advantage. Some, such as that of photosensitization, are valueless and others appear to be superfluous.

In general it may be said that, especially as far as British conditions are concerned, this volume falls between two stools: it is much too detailed and technical for the average farmer, and insufficiently documented for the veterinary surgeon. In view of the very wide field the author has tried to cover this is not surprising: it is to be hoped that he will, either alone or, if necessary, with the aid of collaborators, make sufficient additions to the volume to bring it up to the standard of other purely veterinary text-books of its type.

A.D.O.

Britain: An Official Handbook (1960 Edition). H.M. Stationery Office. 25*s*. (26*s*. 9*d*. by post).

The outstanding value of this book of reference cannot be adequately assessed until you have had an opportunity of turning its 580 pages and of running through its excellent index and extensive bibliography. Produced primarily to present Britain and the British way of life to countries overseas, it is equally an invaluable source of information at home.

Extremely few people in the United Kingdom can justly claim more than a meagre knowledge of Britain—the land itself, the diversity of its industries, the complexity of its government and administration, social structure, communications, and the work and pastimes of its 50 million people. So much that goes to the making of the average citizen's well-ordered day is taken for granted. Merely to dip at random into this book is a cor-

rective—to see Britain as a huge jigsaw, the pieces of which interlock not only literally but in depth as well.

This enlarged, 1960 edition (the eleventh) has been thoroughly revised to take account of developments up to September 1959, and also covers the results of the General Election held in October and the ensuing changes made in Government administration. Among the legislative measures passed during 1959 which are described briefly are those providing for graduated retirement pensions, financial assistance to small farmers and horticulture, loans and grants to assist house purchases, and the future management of new towns in England and Wales. Other subjects now introduced include space research, new developments in the dissemination of the results of research, farm incomes and expenditure, agricultural co-operatives, packaging and advertising; and of particular interest to many will be the new 15-page chapter on sport.

For the student of British affairs, whether a foreigner or a native of these islands, I would prescribe this book unhesitatingly, not as just another volume which it would be nice to have, but as an investment he cannot afford to neglect.

S.R.O'H.

Onion Diseases. ROBERT MCKAY. The Sign of the Three Candles (Dublin). 5*s*.

In these days of rapid progress and limited time for reading, attempts to bring information from a wide field between two covers are always welcome.

Professor McKay, in this monograph, has surveyed the onion diseases found in Eire. For each he has described briefly the symptoms of the crop, the causal organism and the control measure available. The text is clear in style, printed in most legible type, and identification of the diseases is assisted by over thirty photographs. Many of these, particularly microphotographs of some of the fungi concerned, are of excellent quality, but others such as Figs. 1 and 27 provide little help in diagnosis. Photographs of diseases not yet found in Eire, such as smut and shanking, might with advantage replace some of those of common and easily recognized troubles. A list of illustrations would also be helpful.

The book suffers from a lack of arrangement, disease following disease without any obvious logical sequence either from the point of view of symptoms on the crop or the causal agents. Also, as there is no alphabetical index, quick reference is difficult. The choice of references to other works appears to be haphazard, and some of those quoted would not easily be available to the general reader.

In spite of this, the book still presents good value for the modest price of five shillings, and will certainly reach a wider public than the horticulturists of Eire, for whom it is primarily intended. Readers of other nationalities must, however, remember that statements such as "Downy mildew is the commonest disease affecting onions in this country" may not apply to them.

H.E.C.

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